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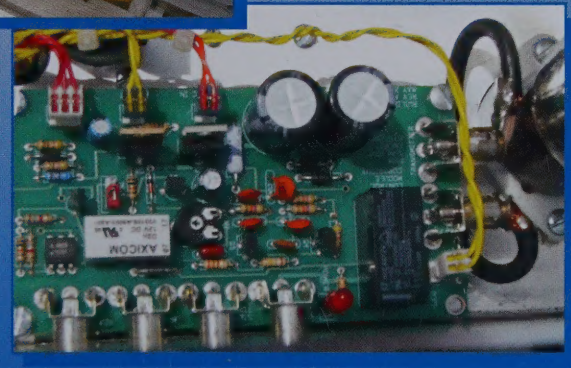
QRP Quarterly

Volume 60 Number 1
January 2019

Journal of the QRP Amateur Radio Club International

WB8VGE says, "Build Your Own Gear"



- Lots of Useful Antenna Notes Collected by VE3IPS
- KC8VWM Goes on a Quest for a Lightweight Portable Antenna
- VE3RRD Explains How Quarter-Wave Stubs Can Be Easy and Cheap
- KK6MC Shows How to Choose a Transverter for VHF & UHF QRP

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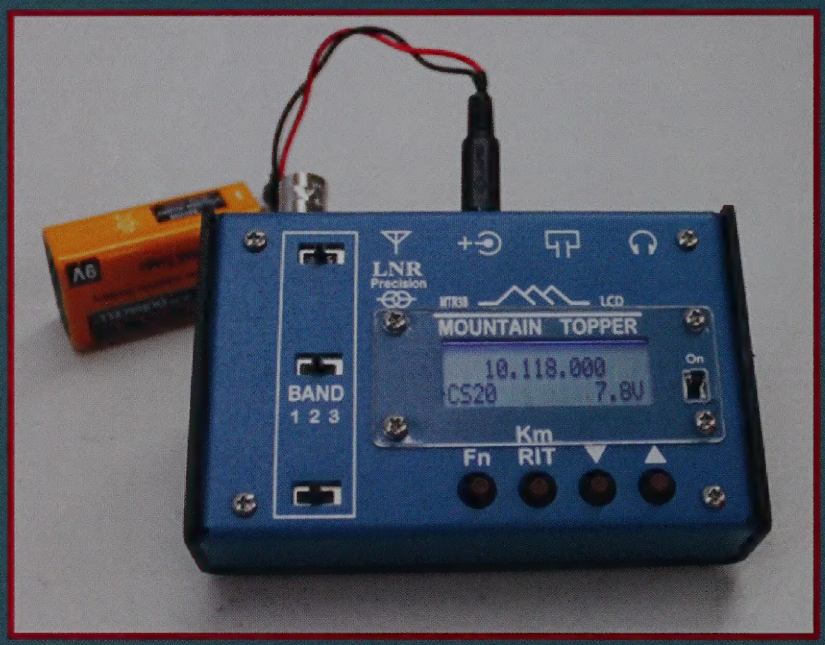

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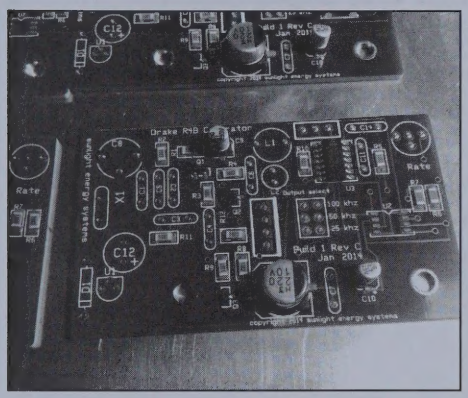

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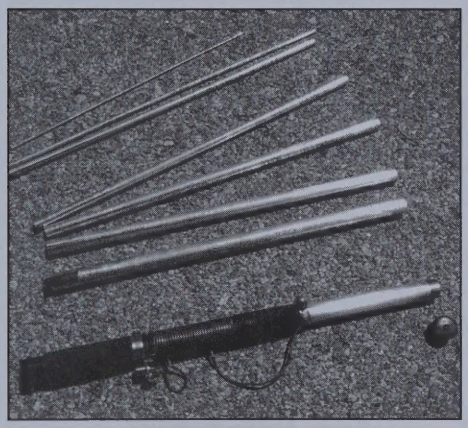

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Technical Articles

The Joy of QRP

The World of QRP ARCI

Check out the *QRP Quarterly* advertisers on covers II, III & IV, and pages 2 & 5 Thank them for their support!

Editorial

Mike Malone—KD5KFX editor@qrparci.org

Comments from the Publisher

The Editor of *QRP Quarterly*, Mike KD5KXF experienced medical problems at the time the material for this issue was to be prepared. So the others on the staff — mainly myself and Associate Editor John VE3IPS — stepped in and took care of things in his absence. Since an editorial column needed to be written, I figured this would be a good time to explain to the membership how *QQ* really works!

First, the Editor has the job of rounding up the contents for each issue. He stays in touch with the Associate Editors, columnists, and the club management, answers inquiries from prospective authors, and tries to find interesting material to be published wherever it can be found! Just like those jokes about herding cats and one-armed wallpaper hangers...

The Associate Editors are major contributors to the process, mainly by recruiting quality contributions from prospective authors. QRPers of all sorts are encouraged to describe their projects and tell their operating stories. The editorial staff collects these contributions, discusses them with the authors, makes sure we get all the photos, schematics and charts, and sends them along to the production staff.

The general idea is simple: get QRPers to share their stories! But the execution takes time and effort. For example, Mike C, WA8MCQ, scours the web and e-mail lists for interesting tidbits to include in his legendary Idea Exchange column. Each Associate Editor does some combination of writing original material, finding other authors, and helping prepare those articles for publication. Although everyone does their part, I'll give an extra shout out to John, VE3IPS for his especially enthusiastic support of *QQ* since joining the editorial staff in 2016.

The other part of the process is keeping membership records, finding new members, encouraging renewals and managing the membership funds—all of which leads to each issue's mailing to current subscribers. Charlotte Nelson, KJ4EDM does an amazing job as membership secretary of the club!

All these people are volunteers. They are taking their turns in the leadership and operation of QRP ARCI and *QRP Quarterly*. Some day, each of you should consider doing your part to help this unique club continue as a strong part of the ham radio community!

Bringing the Pieces Together

First, some background: Around 2001, *QRP Quarterly* had a problem with its own success. The quality of the articles, the number of pages, and the changing technology of printing and mailing had become too complex for volunteer staff to do the "nuts and bolts" of layout, production and mailing preparation. The volunteer editors just didn't have experience with this sort of work. The printing plant and mailing service used by the club helped get things done, but charged extra for the work.

I am not only a ham, homebrewer and QRP enthusiast, I've been a technical writer, editor and publisher for the RF, microwave and wireless industries since 1979. So the club leadership approached me to discuss things. We developed an agreement for me to produce, print and mail *QRP Quarterly* for a modest fee and an ongoing commitment to do the job.

This issue starts my 18th year producing *QQ* for the club. Over that time, I've been able to control the cost of production and mailing, which has kept membership and subscription fees from increasing. It's still a personally rewarding job for me, too. After all, I love to see great QRP articles as much as you do!

72, Gary Breed, K9AY
Publisher
QRP ARCI #6489

From the President

Preston Douglas—WJ2V president@qrparci.org

This spring will be my third FDIM. Two of my jobs for FDIM are engaging great speakers for the seminar and soliciting contributions from the QRP vendors who support our club. Last year we had thousands of dollars worth of merchandise donated by generous vendors, whose names were included in my last president's message. I forgot to mention one vendor who gave a great prize: Tony N3ZN who makes beautiful keys. Just put his call letters in your browser. Shout out to him and thanks for his generosity.

I have an almost full "dance card" of speakers for this year. We'll announce them on the QRPARCI.org website soon But they are going to be a great lineup, not to be missed.

[*Buildathon info is on the website now; speakers should be announced by the time this issue of QQ reaches you —Editor*].

I don't know yet whether I will be handing the reigns off to a new administration this year, but if that happens, it will be after FDIM 2019 is in the books. We are seeing many renewals of our membership, and *QQ* has had many compliments. Thanks to our authors, editors, Mike Malone, and publisher Gary Breed, and all.

You Can't Please Everyone...

I have had a few folks who have one complaint or another. One issue that keeps coming up is our board-approved removal of the PDF option for members. Once again, we are not a commercial enterprise. We don't have staff to prepare and fill these requests. I would add that in my other hat, as an attorney, I have had to send cease and desist letters to pirates who seek to sell our *QQ* online in PDF form. *CQ* and *QST* don't provide their magazines in PDF; they use proprietary software to limit access to their members. We just don't have that capability. Now, if and when I do give over the presidency to the next administration, perhaps they will feel differently.

That said, we do offer an annually updated CD containing all the back issues in PDF format at reasonable cost. Contact our Toy Store manager, Bill Kelsey via the Toy Store on our website. We update at the end of each year, so we're due for that update about now. And if you signed up or rejoined too late for continuous subscription, you can buy back issues, so long as we have stock, from Bill at the Toy Store. Back issues go for five bucks, but we do eventually run out of stock of some issues.

—Preston Douglas, WJ2V
President, QRP ARCI

●●

QRP ARCI Awards Reminder

QRP ARCI provides a number of awards, each of which encourages low power enthusiasts to accomplish a wide variety of goals. We invite you to review the various awards and to make a commitment toward earning your own special award.

A number of applicants submit applications for several different awards at the same time, which is fine. We hope you will review your log and determine if you might be eligible for any awards at this time.

Please note that awards are free of charge for active members (maximum of 5 awards per year)—another significant benefit of active membership. Here are two awards I'd like to highlight:

Shortwave Listener's Award

The QRP ARCI Shortwave Listener's Award is for reception of five (initial) QRP ARCI member QSOs. Only one side of the QSO need be a QRP ARCI member. The submission should include the call signs, QRP ARCI number (at least one), date, time, mode, and frequency of the monitored QSO.

While shortwave listening is not as popular as it once was this award is designed for those who elect to engage in SWLing. There are a number of hams who may have antenna restrictions that limit or severely restrict their participating in two-way, on-air contacts. At one time some countries required prospective hams to verify reception of amateur QSOs, however it is unknown if this is still the case.

Since many hams no longer use QSL cards, or QSL via electronic means, actual QSL cards are not required for this award. The usual endorsements may be requested such as band, mode, or so forth. To make it easy to apply for the award all of the documentation has been saved into an Application Package, available at www.qrparci.org

Elmer Award

The Elmer Award may be submitted by any QRPARCI member on behalf of someone who has helped them along their amateur radio journey. Traditionally Elmers were probably defined as someone, usually an older ham, who provided a helping hand and guidance for someone, usually younger, entering the ham radio community.

In today's fast paced, ever changing world of technology, communication advances, and the advancing age of many hams the Elmer can be viewed from a different perspective. Being licensed for many years, often decades, the tables can get reversed and it becomes the new, often much younger, ham who is performing the role of the Elmer by helping the more senior ham with guidance in new modes of communications and teaching some of the new technologies.

The more senior ham may need help with antenna work or other station needs and the ham who once was considered an Elmer now is in need of the services they once provided. By broadening the scope and definition, more deserving hams may be acknowledged with an Elmer Award by a member who has benefited from their help and guidance.

Remember, you might qualify for one of the QRP ARCI Awards by participating in routine QSOs, contests or other QRP activities.

—Bob Lusby, K9FOH, QRP ARCI Awards Manager
awards@qrparci.org

Idea Exchange

Technical Tidbits for the QRPer

Mike Czuhajewsi—WA8MCQ wa8mcq@verizon.net

In this edition of the Idea Exchange:

Get Down With Your Sloper!

From Joe Everhart, N2CX, #107 in the endless string of Technical Quickies he promised me a couple of decades ago—

Since the US NPS Centennial in 2016, operating portable in parks has become almost an obsession with me. This has continued since then with the US component of the World-Wide Flora and Fauna organization, called WWFF-KFF and the more recent POTA or Parks on the Air, based primarily in the US. A large goal of each of these groups is for hams to operate from lists of parks that they have designated, contacting other hams at their home stations or in other parks.

In times when I'm not out activating a park, I've been thinking of new ways to make these portable ops more effective, primarily in concocting appropriate new antennas. Of course these antennas are also suitable for any portable ham operations.

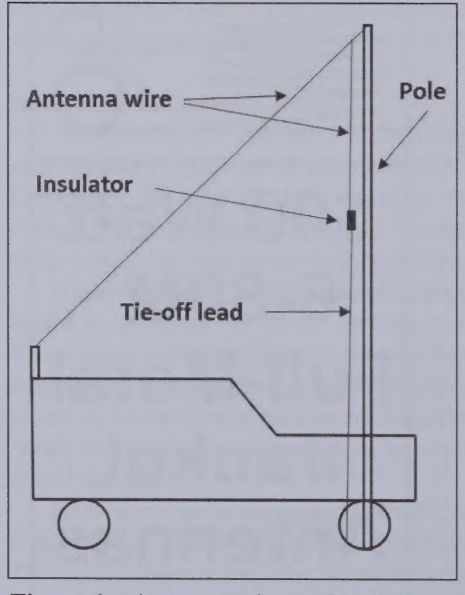


Figure 1—Antenna wire and pole location, side view. (Not to scale)

Over the last several years this continuing series of antenna designs and trials have been documented in some N2CX Quickies (Ref. 1). Much importance has been placed on antennas that are usable in almost any park and easy to set up. Many parks (at least on the east coast) have restrictions on putting wires in trees, erecting large masts, allowing ground penetration for poles or guy anchors and putting up anything that detracts from the scenic nature of the parks and poses potential safety hazards to the public.

Because of these factors, the primary focus of my efforts has been on antennas that are either on a vehicle or permanently attached to one and which will fit in a single parking space. This doesn't necessarily mean actually operating from the vehicle. In appropriate weather it's great to run a feedline to the car and enjoy the outdoors by setting up on a park bench, folding chair or picnic table. To date, the prevailing ionospheric conditions have forced use of the 40, 30 and 20 meter bands.

However, limiting use to only those bands means missing out on opportunities for additional contacts. To date most of my on-air activities have been during daylight hours when these upper bands are optimum. However, at night 20 and 30 meters often go to sleep, leaving 40 as the only choice. In addition, propagation on 40 under night conditions stretches out to several hundred or thousand miles so more local contacts are difficult. A logical thing to consider, then, is to use the 60 and 80 meter bands.

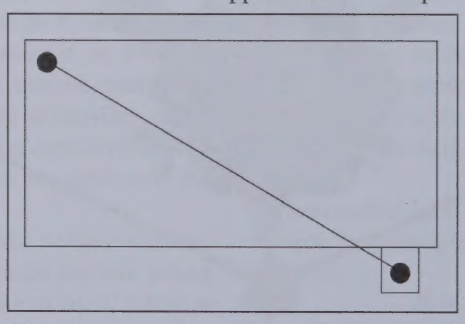


Figure 2—Sketch of antenna wire and pole location, top view.

These frequencies inherently offer shorter hop distances both during daylight and night-time periods. One part of this is that they are excellent for what is called Near Vertical Incidence Signaling, or NVIS (Ref. 2). What this means is that at these frequencies the ionosphere reflects signals sent directly overhead back to Earth at close-in distances, while at higher frequencies these high angle signals pass right through into outer space.

I have used mostly vertical antennas for my portable ops since they are most practical on a vehicle. Any horizontal HF antenna would be far larger than the footprint of anything shorter than a tractor-trailer. Vertical antennas by nature radiate

Figure 3—My drive-on antenna base support.

Figure 4—The original 80 meter loading coil.

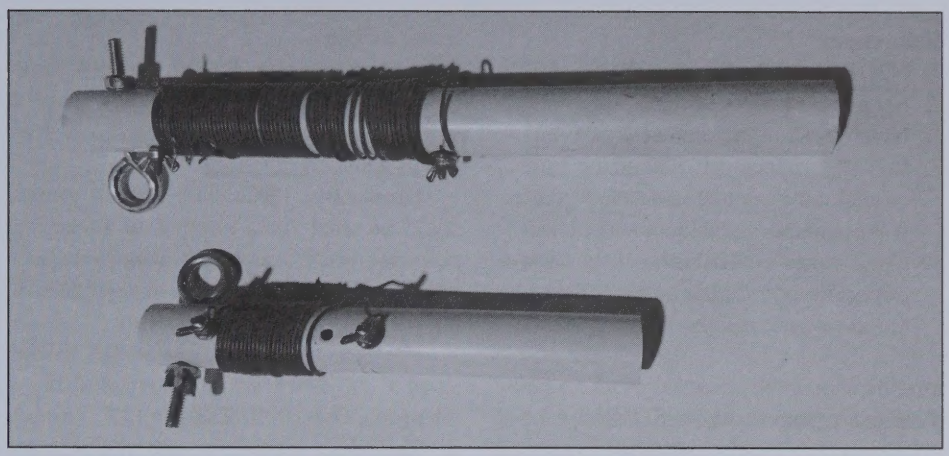


Figure 5—Proof of concept loading coils.

at right angles to their length, meaning that they have almost no high angle radiating capability. Horizontal antennas, on the other hand, are capable of producing the desired high angle signals needed for close-in NVIS work. Magnetic loop antennas also give high angle radiation but to be efficient below the 40 meter band they need to be large and are awkward for fast portable setups.

As with many things, there is a compromise solution. A 40 meter antenna I have used effectively with my car is a sloping wire that runs from one corner of the back of the car, diagonally over the car to a 30+ foot telescoping pole at the front corner on the other side (Figures 1 and 2). The pole is held in place by a drive-on support under the front tire (Figure 3, which appeared in an earlier Quickie). The wire is electrically a quarter wavelength on 40 meters so it is resonant. The vehicle chassis is used as an electrical ground to maximize radiating efficiency.

The beauty of this antenna is that it gives good performance, is still attached to my vehicle and will fit in a standard parking spot. And as a bonus, since it slopes from about 6 feet to 30+ feet above ground, it radiates at least some high angle horizontal signal! This has proven effective for close-in contacts on 40 meters when the gassy layer in the sky cooperates.

To duplicate this sort of thing for 60 meters would require a wire about 44 feet long and a correspondingly larger vertical support. Even worse, for 80 meters the wire length would be a very impractical 66 feet. A practical solution is to simply use the same 40-meter quarter wave sloper and add loading coils to resonate it on the lower bands.

I chose to do this by winding coils on a PVC pipe slipped over the mobile mount at the feedpoint. Actually, I had shown this in Quickie 98 (see Figure 4) but had somehow mislaid the original coil since that was published.

The method chosen to design the inductors was simplified to avoid paralysis through analysis. The decision was to calculate the needed inductance using a handy web-based calculator (Ref. 3) then employ another calculator to see about how many turns were needed for the coil (Ref. 4). The coils were wound with 10% more turns than calculated. Finally, they were hooked up to the sloping wire and the resonant frequency measured.

Turns were removed to bring the antenna to resonance at the chosen frequency. The 80 meter calculated inductance was 56 uH, and the estimated number of turns of 20 gauge insulated wire on the PVC pipe was 66. Once resonated at 3.56 MHz, only 61 turns were required. For 60 meters the target inductance was 23 uH, with 26 turns. After adjustment the final turns count was 23 at 5.3 MHz. The whole process took an hour or so of calculation and a couple of hours to wind the coils and set them on frequency. Figure 5 shows the crude prototype coils, which will eventually be cleaned up.

This work was done in relatively benign weather in early Fall of 2018. Some quick checks on the air yielded contacts with no difficulty even during daylight hours. RBN* hits on both bands were in the teens of signal to noise ratio, indicating that the sloper was putting out reasonably well even with a 5 watt CW signal. The antenna hasn't been used much since initial checkout since Winter has now caused temperatures to plummet and brought windy conditions that make setting up the large antenna pole in the dark rather challenging. In fact, even operating portable during night hours in the Winter is more than this old man cares to tackle. Rest assured, though, that come Spring, with longer days and moderating temperatures, late day operating will once again resume.

[**WA8MCQ note—RBN is the Reverse Beacon Network, found online at http://www.reversebeacon.net/ It is a network of stations monitoring the bands, reporting what is heard, the location where it hears it, and how well.*]

What's next? The 16 foot base loaded vertical on the car works well on 40, 30 and 20, and it is not too tough to erect when Old Man Winter is doing his worst. A couple of sets of better built loading coils will be made to put it on 60 and 80. The efficiency will of course be lower, and there will be no high angle radiation for NVIS, but having two additional bands just might bring in a bunch more contacts in the N2CX portable park ops. Stay tuned!

References

1. N2CX Quickies 96, 97, 98, 101, 102
2. https://en.wikipedia.org/wiki/Near_vertical_incidence_skywave
3. Loading inductance calculator https://m0ukd.com/calculators/loaded-quarter-wave-antenna-inductance-calculator/
4. Coil turns calculator, http://www.66pacific.com/calculators/coil-inductance-calculator.aspx

—DE N2CX

Transistor Sockets from SIP Strips

From Dale Parfitt, W4OP—

I was recently repairing a Yaesu FT-7 HF transceiver. The front end dual gate MOSFET was shorted and I could see that it had already been replaced at least once. I did not have a replacement 3SK40M device but did have a lot of 3N201's.

These early phenolic PC board traces can lift pretty easily. Once I had removed the bad transistor I cut up 4 pieces of a machined pin SIP strip (Figure 6) and installed them into the 4 PCB holes (Figure 7). This makes a nice socket for trying different devices.

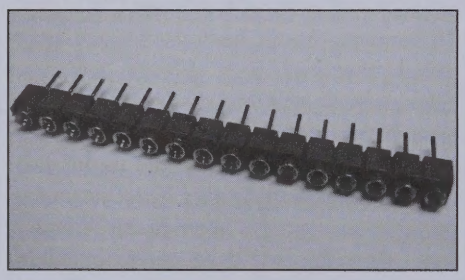


Figure 6—A strip of machined pin SIP sockets.

Figure 7—Individual pieces of the strip are cut apart and used as a socket, preventing any further damage to board traces.

Fortunately the 3N201 has the same pinout as the 3SK40M. The new device works very well and also has diode protected gates.

Obviously, these SIP socket pieces could be used for a number of socketing purposes where one might want to experiment on a PCB without the danger of lifting pads from repeated soldering.

—DE W4OP

Cleaning Out PCB Holes

This discussion appeared recently on the online QRP-L forum.

From Bill Hulley, K7WXW—

While building a kit with DIP ICs, I made a mistake and had to remove one of them. I cut the pins from the body to get it off the board. I've cleared most of the through holes, but not all. In two, there is a bit of the pin with the ends level with the PCB. In two others, which are connected to the ground plane, are pins that I can't seem to get free. I've tried both solder wick and a decent quality solder sucker without success. I am using a good, temperature controlled soldering station.

After repeated attempts to clear the through holes, the board is pretty close to a loss from heat damage. I am contemplating clearing the holes with a drill.

I am trying to salvage my lousy morning at the bench by turning it into a teaching moment. I would love to hear some rework tips from the experienced builders here. I am pretty sure this won't be the last time I have to remove a part from a through hole style board.

—DE K7WXW

From Chris Waldrup, KD4PBJ—

If a solder extractor or wick won't work, take a super fine sewing needle and, while heating the joint, try to push the piece of DIP lead out. You don't want a needle large enough to damage the plated barrel (via) inside the hole. If you can get a stainless steel one, it won't take the solder so should remain clean.

—DE KD4PBJ

From Dan Trigilio, W6DAN—

Try using a toothpick to push the pin out as you heat the hole in the PCB. The solder will not stick to the toothpick.

—DE W6DAN

From Mike Dooley, N5BGZ—

The problem with the pins in holes connected to the ground plane is that you are not getting them hot enough quickly enough. You are leaving the iron on too long trying to melt the solder but the ground plane is eating up too much heat and the end effect is that you are cooking the board. You might try a larger iron, or turn up the temperature on the one you have.

—DE N5BGZ

From Ron D'Eau Claire, AC7AC—

A drill may be the way to go if the board is showing heat damage, but be very careful not to cut out the entire through hole pad, especially if the board has more than front and back layers. A two sided board is no problem; just be sure you solder the new parts lead to both the top and bottom sides; hopefully it isn't a relay or other part that totally obscures the pad on one side of the board.

Reworking a lot of boards with nothing more than a solder sucker and occasional solder wick, I have found that it is important to use a hot iron. I run mine at 800 to 850 degrees when pulling parts. That allows me to get the iron off the board quickly and avoid damage. Parts handle it well too, even sensitive ICs.

I hold the board in a fixture so I can apply the iron on one side with the solder sucker on the other. Use some fresh solder on the iron to ensure quick heat transfer, and press the sucker button as soon as you see the solder melt.

When using solder wick, I always brush some additional fresh rosin flux onto it. That makes a world of difference in wicking up the solder. I have a 2 oz bottle of GC Electronics Solder Flux (rosin), part number 10-4202, that has lasted me many hundreds of parts pulls with solder wick. Again, a hot iron is necessary because the wick is an excellent heat sink.

In my experience, the biggest danger is not using a hot enough iron, then and leaving it in contact with the board too long. I have pulled a great many parts, both as a radio/radar tech on aircraft and ships and as an active homebrewing ham. I have yet to lose a board using those methods.

—DE AC7AC

Follow-up from K7WXW—

Thanks to all for the suggestions, tips and guidance. The toothpick/needle idea

helped me get the through holes cleared of the bits of pins. Flux on the solder wick helped, too. Last of all, turn up the temperature when doing rework!

I was able to install a new IC and when I checked for continuity at the troublesome spots I found that I hadn't destroyed any traces, although I may have battered a few. I finished building the kit, did the test and calibration procedures, and my device is working to spec.

I haven't reworked a PCB for close to forty years and I am apparently learning from scratch.

—DE K7WXW

WA8MCQ comments—

Myself, I make it a habit to never use a needle or pin to clean out a hole due to the possibility of damage to vias. If the board is single or double sided it's not a major issue, but if there are internal layers it can be (and you may not know if there are any). I always use round wooden toothpicks. The small end of a flat wooden toothpick would also work, but the "wooden" part is not negotiable. Don't forget, some toothpicks are plastic and those will melt and leave a nice mess.

As for a fixture to hold boards, one option is the PanaVise 324 Electronic Work Center, which I used at one of my previous jobs. The price varies a bit depending on where you get it, but it's close to a hundred dollars. You can see one by going to Amazon.com and searching for "PanaVise 324".

The QRP-L forum can be found online:

http://www.qth.net/mailman/listinfo/qrp-l

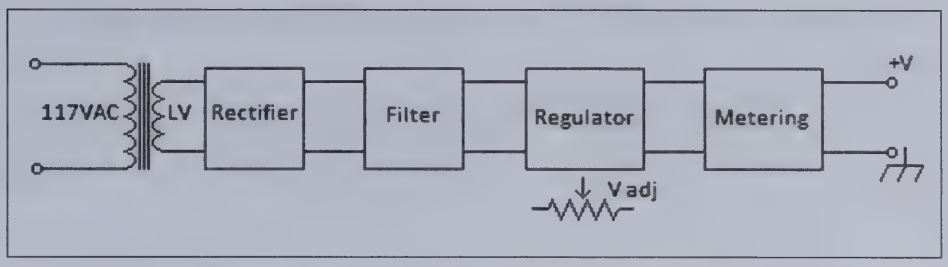


Figure 8—General structure of a typical low voltage power supply.

It was created in 1992 by Chuck Adams, K7QO (K5FO at the time) and moved from the original host to qth.net in 2004. Archives from the present back to 2004 are available at qth.net

Another Low Voltage Power Supply

From Bryant Julstrom, KCØZNG—

In an adjustable, regulated low voltage power supply, the regulator is usually built around an LM317 or similar three-terminal device, or less often an LM723 with a pass transistor. Figure 8 shows the general structure of such a supply.

Regulated supplies can also be based on other, less well-known integrated circuits. One of these is the TL431. This device is an adjustable shunt regulator whose output voltage can be set between 2.5V (its reference voltage) and 36V. It is available from the usual suppliers in surface-mount and through-hole packages, including TO92 and 8-pin DIP, for about 50 cents in single quantities. A TL431 alone can handle only a limited current, so a general-purpose supply includes a pass transistor.

Figure 9 shows the circuit of a TL431-based adjustable regulator. As in regulators based on more common devices, a voltage divider across the circuit's output applies a fraction of the output voltage to the regulator. The regulator in turn controls the NPN pass transistor.

Figure 10 shows a bench power supply that uses this circuit. It was rebuilt from a fixed-voltage supply found at a hamfest. The TL431 is the TO92 package in front of the large electrolytic capacitor, partially hidden by a wire. The pass transistor is mounted on the back panel, so that the case serves as a heat sink.

The TL430 is another shunt regulator that can be used in this way. The pass transistor can be any NPN that can handle the desired output current; the 2N3055 is a frequent choice. Metering can be analog or digital; digital meters may be powered by the output or by another small supply.

—DE KCØZNG

WA8MCQ comments—

When installing a TL431, check carefully to be sure you have the correct pinouts. In some packages, such as the SOT23, they may be provided in two different ways; as shown in Figure 11, on the next page.

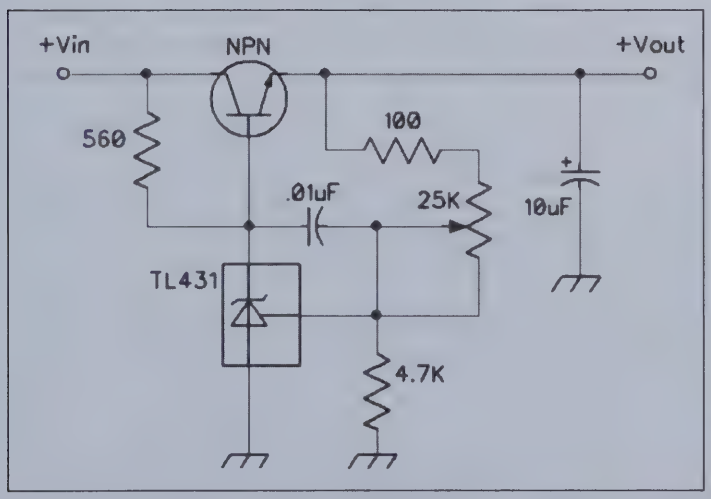


Figure 9—TL431-based adjustable regulator.

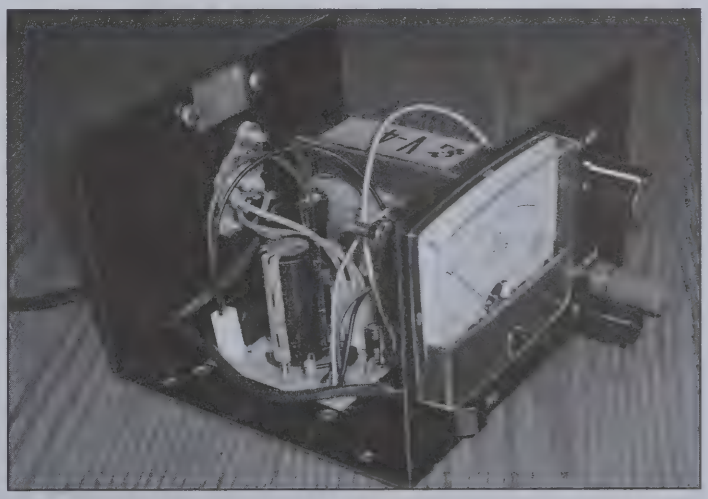


Figure 10—Bench power supply using the circuit of Figure 9.

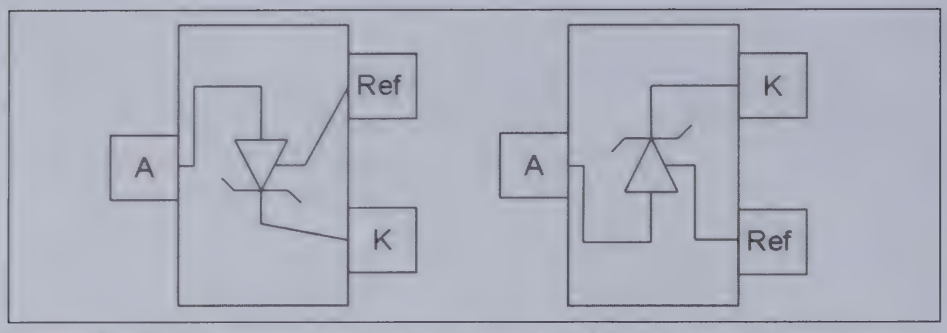


Figure 11—TL431 connections. Packages are available with two different pinouts.

Failed Twist-Lock Electrolytic Capacitors

A discussion on the online HP-Agilent-Keysight-equipment forum shifted gears a bit and started talking about these. A lot of equipment uses multi-section electrolytic capacitors in cans, which happen to be mounted with twist-lock tabs. What to do if a single section of one goes bad? While it may be possible to find an exact replacement, Jeremy Nichols, N6WFO, pointed out that those tend to be expensive. He recommended leaving the partially failed unit in place, removing the wire(s) from the bad section and soldering in a suitable replacement capacitor, which he had done to a number of devices.

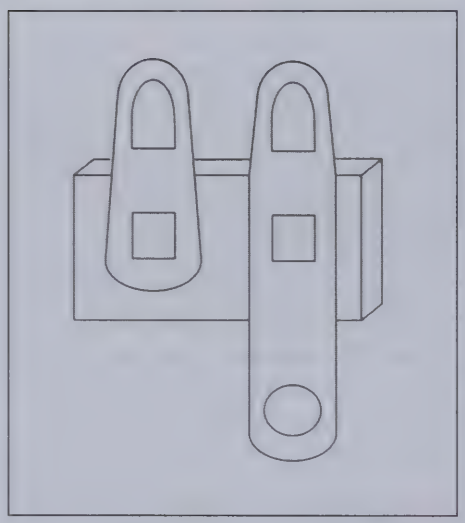


Figure 12—Typical terminal strip with one isolated lug.

Brad Thompson, AA1IP, replied—

Temporarily shunting a possibly failing chassis-mounted multisection "twist lock" electrolytic capacitor with a known-good capacitor can often confirm whether a replacement is needed. However, if you decide to replace a capacitor and leave the failed original in place, don't use the old capacitor terminals as tie points for the new capacitor leads. It's convenient, but the original capacitor can misbehave by short-circuiting or presenting a low resistance, or by bursting due to chemical decomposition.

One fix that requires no drilling through a crowded chassis uses a section of a phenolic tie-point strip such as those from All Electronics.

https://www.allelectronics.com/category/755500/terminal-strips/tie-points/1.html

Remove the wire leads from the terminal of a bad section and solder them, along with the positive lead of the replacement capacitor, to the isolated terminal on the strip. Connect the other end of the new cap to a nearby ground point. Solder the remaining terminal (or chassis mounting tab) of the strip to the now-disconnected terminal of the defunct capacitor to hold it in place.

[*WA8MCQ note*—My drawing in Figure 12 shows a typical terminal strip with one isolated lug. The chassis mounting tab may or may not have a lug as well; this one does. If you are uncomfortable with relying solely on solder for the mechanical connection, wrap a couple of turns of bare wire around it before soldering.]

—DE AA1IP

The Fine Print

The usual rules apply; send your ideas and projects to me any way you can get it here (e-mail, snail mail, 3 1/2" floppy disk, CD, handwritten on a napkin, etc), or tell me where you found something good on the Internet. My addresses are 7945 Citadel Drive, Severn, MD 21144, and wa8mcq@verizon.net.

If you have something of interest and aren't sure just where it should go in the *QRP Quarterly*, send it to whichever member of the editorial staff you think is best, and they'll pass it along to someone else as appropriate.

Important note—when you send me something, you must get an acknowledgement from me. If you don't get one, either it never got here or I overlooked it. (Although very rare, both have happened.)

Well written, Pulitzer Prize quality articles are nice, as are computer drawn schematics, but don't worry if you can't do all that. We'll take care of the rest, editing, redrawing, etc. The readers are waiting!

●●

ANNOUNCING:

FOUR DAYS IN MAY 2019

May 16-19, 2019 • Holiday Inn • Fairborn, OH

Information: www.qrparci.org/fdim

QRP-ARCI's FDIM 2019 is in the works. Register NOW!

Get it on your calendar now! Thursday-Sunday, May 16-19, 2019.

If you haven't attended before, this is a great year to make it your first. QRP ARCI is sensitive to the first-time attendee and will try hard to make your first FDIM as fun and interesting as possible. We also make an effort to provide spouse activities.

We will again be at the Holiday Inn, Fairborn, OH. Reservations are available now through www.QRPARCI.org. Remember, all discounted hotel rooms are released only through QRP ARCI.

Registration and getting acquainted begins on Wednesday evening. Seminars are most of the day Thursday, with "meet the speakers" and an open room for some casual show and tell and plenty of time to swap tales that evening. Most of Friday daytime is open to attend the Hamvention and visit the QRP-ARCI Toy Store. Friday evening activities usually include "show and tell", vendor displays and maybe a judged home brew contest. Most of Saturday is again open for the Hamvention, and we have a great social event, banquet, awards presentation and door prizes that evening. Sunday is the Hamvention, and check-out.

Most of the speakers for the seminar have been contacted and confirmed. We'll have a "meet the speakers" social gathering after the seminar, where you'll have an opportunity to meet, question and discuss QRP with the speakers.

Don't miss out on the show and tell. You can to bring out your QRP related projects and put them on display. Your contemporaries will have a chance to roam through the displays and see the excellent craftsmanship used in these special exhibits.

It shouldn't surprise you to find a contest or two during the weekend. We've had QLF, split paddle, CW and other fun activities in the past.

We're lining up vendors for the vendor showcase. One evening, there will be several vendors with QRP related products displaying their wares. Many will offer special FDIM discounts.

In the past, the hotel has been accommodating with discount meal tickets. You'll find fast food restaurants across the street from the hotel.

This is preliminary information. A complete schedule and list of activities will be posted on the web site as we move through the process.

FDIM Dates:	16-19 May, 2019
Location:	Holiday Inn, Fairborn, OH (Hotel reservations only available through QRP ARCI!)
Seminars:	Thursday, 16 May
Club Night:	Friday, 17 May
Show-n-Tell:	Friday, 17 May
Buildathon:	Friday, 17 May
Banquet:	Saturday, 18 May (lots of prizes!)

Questions or comments

Norm Schklar, WA4ZXV, FDIM2019 Chair
fdim@qrparci.org

FDIM 2019 Homebrew Contest and Show-and-Tell

Friday, 17 May 2019, 8 to 10 PM

As in the past, we intend to allow entries in the Homebrew Contest to be displayed in the Ballroom on Club Night, Friday night, May 17, between 8 PM and 10 PM. To enter an item in the contest and insure that it is part of the voting (on Friday night), you must register your item on Friday night between 7 PM and 8 PM. A registration table will be outside the main Ballroom at that time on both nights.

FDIM 2019 Buildathon— by Rex Harper, W1REX

Friday, 17 May 2019

So this year, the FDIM Buildathon with be a little different. We will build a simple little O*Scope FUN! board for generating nice predictable signals to measure while we learn how to use a pocket oscilloscope... a little build time... and a little learning time! The price is a little higher for this FDIM as everyone will leave with *both* the O*Scope FUN! learning board and a very nice JYETech DSO Shell pocket oscilloscope. The scope sells for $39 at Circuit Specialists, but I have made arrangements with them to get the scopes at a reduced cost in order to keep the Buildathon price at $50.

10 Questions About Your QRP Operations

John Leonardelli—VE3IPS VE3IPS@gmail.com

The simple game of ten questions is a starting point to conversation and inspiration to use what other people are using. Please share with the other readers your answers by sending me an email with your answers. Thanks for the contributions as I even got one via snail mail.

Get out and operate today! 73s

VE2TH at Trois-Pistoles Campground.

VE2TH Michel

Q1: Favorite Mode: CW

Q2: Current QRP Radios: FT-817ND, IC-703 Plus & Elecraft KX3

Q3: Favorite Antenna out in the field: HYENDFED antenna,of Netherland, & by the sea, home made fishpole vertical. Plus Buddipole/Buddistick/ Buddi-Beam for 6 & 10 meters.

Q4: What Contests do you participate in? NAQCC, CQWWDX Contest, State QSO Parties, Canada Day contest, 6 meters VHF Contest, QRP ARCI contest. I am not a serious contester but I do sometimes like to dabble in the QRP ARCI and RAC Contests and also the Ontario QSO Party.

Q5: What is on your wish list? To get portable operations down to routine, and Bicycle mobile. Also, a small solar panel with charge controller.

Q6: Operating tips: Listen listen and listen , search and pounce, and patience, it always gives me very good results.

Q7: Do you use any tablets, smartphones or laptops in the field? Yes, cellphone, but it stays in the car, because wherever we go in the great outdoor, there is not much cellular signal.

Q8: Batteries or Power choice: K2BATTERY.COM Lithium Iron Phosphate Battery 13.0 volts 10 amps. it weighs about a pound, check the model K2B12V10EB.

Q9: What's smartphone apps do you use? None

Q10: Do you pack a First Aid kit out in the field? Always, we refresh it every spring, better to have it and not using it, than need it and having nothing!!!

Best QRP Memory: And my best long distance QSO, 17123.2 KM, FT5XO, Kerguelen Islands, Antartica AF-048 on 30 meters, with an inverted-vee for 30 meters. But I have many more good memories, over those 55 years of hamming it could take many books..

G0RQQ operating Mills-On-The-Air.

Keith GØRQQ Lincoln & VA2QU Montreal

Q1 Favorite Mode(s): Equally split between CW and PSK31. Nowadays I prefer to exchange more than just a report and actually have—gasp—a CONVERSATION!! I have done quite a bit of QRP SSB in past, but now prefer other modes.

Q2 Current QRP Radios: FT920 run at QRP power levels (it has a great receiver!). Also the ubiquitous FT817ND, Xiegu X5105, MTR3b, and Frog Sounds (!!) 40m xcvr.

Q3 Favorite Antenna out in the field: Half-Wave end-fed using links to select 40/30/20m

Q4 Contests: Don't participate in contests any more—see Q1 above.

Q5 Wish list: To operate from some exotic location, maybe a Scottish or Irish island, or even Nepal.

Q6 Operating tips: Have patience. Lots and lots of patience...

Q7 Smart phone: I have one, but just used for emergencies.

Q8 Batteries: Internal batteries for the 817 and Xiegu, and regular 9V batteries for the MTR and Frog Sounds.

Q9 Smart phone apps: None

Q10 First Aid kit: Yes, a basic one.

Best QRP memory: Switching on the MTR for the first time and immediately working UE99PS on 30m, celebrating 99 years of the KGB Border Troops. Also working a US station in a contest who refused to believe I was giving him my power level (1 watt) and not a serial number and so replied "No QSO"!!

WA6ARA hilltopping on CW.

Mike WA6ARA

Q1 Favorite Mode: CW

Q2 Current QRP Radios: Elecraft KX1, KX2, KX3, K2 NC40, BitX40, and a plethora of homebrew rigs.

Q3 Favorite Antenna out in the field: vertical using various Buddipole, homebrew parts and AN-131 whip.

Q4 What Contests do you participate in? : ARRL 160 CW, Novice Rig Roundup, Field Day (yea, I know, it's not a contest but they do keep score)

Q5 What is on your wish list?: Improving my CW speed and head copy

Q6 Operating Tips: 1) Get on the air, 2) the only "bad" antenna is the one that is never put up, 3) take what the "experts" with a grain of salt, 4) experiment.

Q7 Do you use any tablets, smartphones or laptops in the filed?: Occasionally a smartphone while SOTA

Q8 Batteries or power source of choice: Bionneo LiFe 3Ah in the field, 10Ah LiFe at the cabin, and lead acid + solar at home

Q9 What smartphone app do you use?: AMSATdroid, SOTA spotter

Q10 Do you pack a First Aid kit out in the field? Absolutely!

Best QRP Memory: Hard to say, Working W7ZOI using a homebrew rig, or Spain while SOTA, as well as just rag chewing on CW on a raining day are all high points.

From VE3IPS:

Help! I need to hear from more DX and USA operators—us Canadians can't be the only QRpers.

This is a fun way to share your QRP experiences, and to see how other hams like to pursue this great hooby!

Send your answers to these 10 Questions (plus Best QRP Memory) to me at VE3IPS@gmail.com ●●

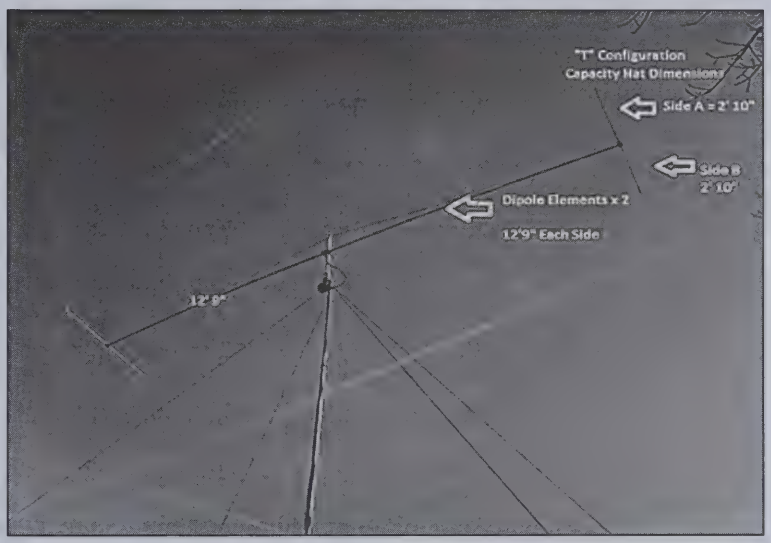
Antenna Notes

John Leonardelli—VE3IPS VE3IPS@gmail.com

T Dipole Antenna

Charles W Bushell, KC8VWM

This is a simple T Dipole using capacity hats to provide a reduced size. It does use a 28 to 50 ohm matching network based on a DK7ZB design. Capacity hats have some advantages over using coils. Secondly, capacity hats placed on the end of the antenna helps it function more efficiently because it helps to improve currents flowing along the antenna elements and it also helps to improve bandwidth coverage. Thirdly, capacity hats can reduce the physical size of the antenna without significantly impacting antenna performance, if at all. Typically a 20m dipole requires antenna elements that are 16.5 feet long on each side. Using the capacity hats in my portable dipole has reduced the antenna elements to 12' 9" on each side and the capacity hats being 2' 10".The antenna in the photo below is setup for 20m operation, however it was constructed so it can be quickly reconfigured in physical size (telescoping antenna elements slide in and out of one another) and when readjusted it can be used on any amateur radio band anywhere from 6m through 20m with a perfect SWR and no antenna tuner required.

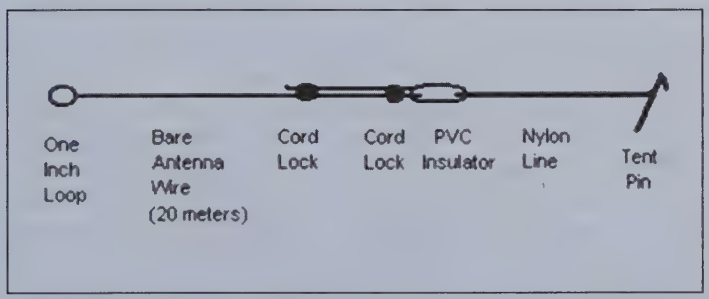


The T Dipole antenna. Capacity hats shorten 20M band elements from 16.5 ft. to 12 ft. 9 in. on each side.

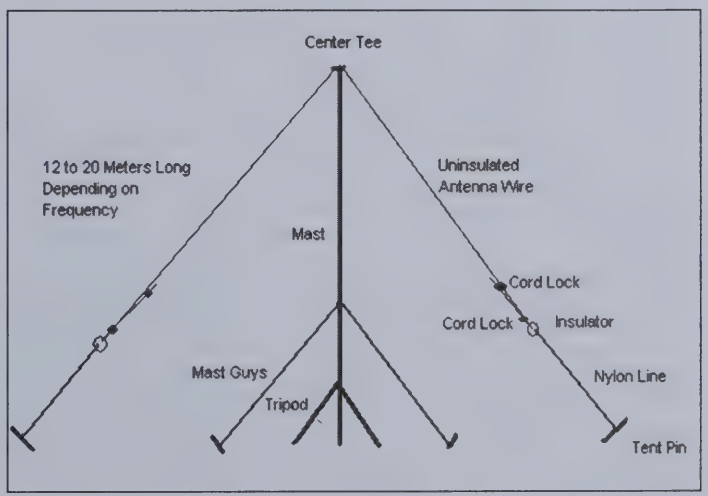
The Buddipole N-Vee NVIS Antenna

http://www.w0ipl.net/ECom/NVIS/cbp-nvis.htm

Here is an idea for an NVIS antenna for 80 and 60 meters using Buddiole parts with homebrew additions.



N-VEE NVIS antenna leg assembly (two are required). Attach loops to CBT Center Tee with adjustable arm adapters.



The Buddipole N-VEE NVIS antenna for 80/75/60 meters.

VB1M: The 2018 Bon Portage DXpedition

Fred Archibald— VE1FA

A DXpedition for the IOTA Contest

This year was the 20th Maritime summer island DXpedition in a series going back to 1991. The series started with a crew entirely from Montreal's West Island ARC (WIARC), but the present gang contains four hams in the Halifax ARC, five in the Kings County ARC, and Mark, our token WIARC guy! The 2018 BP crew: Rich VA1CHP; Lowell VY2OX; Wayne VE1BAB; Fred VE1FA; Helen VA1YL; Al VO1NO; Mark VA2MM; Sheldon VE2GPY; and Bob VE1RSM.

This was our 6th radio trip to our favorite island, Bon Portage (BP, NA-126), off Shag Harbour, NS for the 24h annual IOTA contest in the last week of July. Our exact QTH is the island's southern tip, which has the best antenna location you can imagine around the well-maintained light-keeper's house. This old light station is operated by Acadia University as a biological teaching and research station, and Acadia Biology was happy to welcome back "Fred's Class" for 2018.

Tuesday, 24 July. We arrived on Shag's main pier and were delighted to find a BIG Cape Islander waiting; it carried the nine of us and our heap of gear to BP in a single trip, instead of the usual two! Creeping across a mile of water in pea-soup fog, we found a crew busy re-building the BP pier. They kindly took a break and turned their efforts to getting all our gear off the big boat, into a dory, on to the ramp, and then on to a big diesel "Gator", a second ATV, and down the 1 km of rocky pseudo-road to the light-keeper's house. We were ready to set up in record time!

The first things we organized upon arrival were sleeping areas and the food. There are plenty of bunks and beds, so we only bring sleeping bags. There is a big eating and cooking area with a gas stove. Since we planned to be on BP for 6 days, six of us made up dinners at home for the whole group, and froze them. Thus a big part of food prep was done before we got there. All six were good, but I vote for Rich's volcanic jambalaya as the best!

Every year we look for ways to improve, and that has led to a set of antennas and antenna supports that we feel are an optimum compromise between: (A) performance in the IOTA contest; (B) portability; and (C) ease and safety of erection. Since we are now returning to the same QTH each year we leave six 10 ft. tower sections in the lighthouse, reducing what we have to bring. We run in the annual IOTA Contest's "Multi-op/high power/24 hour/Island DXpedition category, which means we have two 500W HF stations ("Mult" and "Run") less than 30 ft. apart in the lightkeeper's house, and each needs a set of antennas for 80-40-20-15-10m, AND each should NOT interfere with the other! [*OK, it's not QRP, but it's portable, it's fun, and there are QRP ops in the log! —ed.*]

Here's our current set of BP antennas. RUN station: TA-33 triband beam; 40m full-size vertical; 80m full-wave vertical loop. MULT station: A3 triband beam; 40m full-size phased verticals (2); 80m low inverted vee dipole.

All had worked perfectly in past years, but Murphy was our silent 10th expeditioner. First the TA-33, after years of good behavior, showed terrible SWRs, and had to be taken back down. The problem? A bad rivet in one of the driven element's traps. As soon as TA-33 beam was back up, the A3 beam's SWRs went from good to poor! The problem was moisture... we were in fog and mist, (i.e., normal BP weather) and the beam was dripping wet much of the time. This we had to live with.

As a result of many trials in past years using a variety of filters, baluns, judicious antenna placement, and good grounding, we had reduced inter-station QRM to levels not interfering with the contesting. However, in 2017 we had severe inter-station QRM that reduced our ability to run both stations simultaneously. So, this time we replaced our elderly TS-850 transceiver and analog power supply (total 50 lbs) with a TS-590SG and switching supply (total 19 lbs). The 590SG has much better key performance numbers (lower phase noise, higher close-in adjacent signal rejection, and greater dynamic range) that should help minimize inter-station QRM. We also replaced 2017s Mult station Flex SDR transceiver with an Elecraft K3, and we went to Elecraft KPA-500W linears in both stations.

We had both stations completely set up two days before the contest began, so we used some of this time to measure the same-band and cross-band interference between the two stations. In general, cross-band interference was absent, or present only at low levels. Same-band was somewhat higher but not serious. For example, one 500W station could be sending CW in the 20m CW sub-band and the other station listening anywhere the SSB portion of 20m would hear only an S-2 or less hiss from the powerful CW signal, and this is with the two stations less than 30 ft. apart!

Our main goals in going to BP were to have fun and to do better in the contest than we did last year. For three of the past four IOTA contests our score was in the 3.0-3.5M point range, then last year it fell to 2.0M, mostly we think due to poor propagation and the self QRMing. Could we do better in '18??

Fred 'FA and Helen 'YL in the Run station started the contest at 09:00 local (12:00 UTC), 28 July on 20m phone pointed towards Europe. "CQ CQ CQ ...this is VB1M, VB1M on NA-126... standing by" Oh no! The White Wall again! The White Wall is when the band is unnaturally quiet, the S-meter is hovering around 0, and from time to time a few words or a call will rise up (often quite clearly) out of the nothingness. You know that in Europe the band is packed with strong signals from the thousands of hams in the contest, but the ionospheric skip just isn't there. You frantically call back, armed with your with beam, 500W, and a great ocean takeoff, but you're not heard. You eventually give up and turn toward the US and Canada and pick up some low value non-island stations. Frustration!

Eventually 20m opened up to Europe, and as the afternoon progressed CW alternated with SSB, other bands were activated, and our score rose. The guys in the Mult station were jumping around the 5 contest bands and back and forth between CW and SSB, picking up new band-islands (mults), and while they made far fewer QSOs than the Run station, each mult (new band-mode-island) is worth a lot of points! Computer gurus Mark 'MM and Sheldon 'GPY kept our N1MM logging and the

computer network behaving.

Late at night is often the most fun, when the band is quiet and the contacts are coming at a relaxed rate....then a VK or ZL or AH jumps in to say hello and give you a new island!

At 12:00 UTC Sunday (9 AM local) the radios finally fell silent. We had 2.2M points in the log... but that's before IOTA's Contest Robot has sunk it's yellow teeth into our log and exposed every tiny error or omission we made... and punishes us for them! In my mind the Contest Robot looks like Jabba the Hutt. Seriously, the adjudication process is an excellent way to see exactly what errors we're making, and what is needed to improve our accuracy.

As our pre-tests suggested, we had virtually no problems in the contest with self-QRM. So what exactly decreased the self-QRM so much in 2018? The two-station system we set up for the IOTA contest is really quite complex. It was much wetter and foggier this year and the A3 beam was misbehaving. The radios, linears, and power supplies were different. There were some filter changes. The phased 40m verticals were in a different location. The stations weren't on a generator separate from the house power. We suspect the radio changes were the most important, and we'll probably incorporate them into next year's setup.

We thank Lee, Jason, our ferry skipper, and the dock crew for their help!

For VB1M cards, send your card to VA1YL, via the buro or direct to her QRZ address.

—de VE1FA

Let's Use Better Vertical Antenna Radials!

John Jaminet—W3HMS

To me, QRP radio on a park bench near a lake is a great summertime experience. Untangling bunches of radial wires is NOT a most enjoyable summertime experience!! The existence of cheap measuring tapes at Harbor Freight, USA and no doubt other vendors in many countries opens up new possibilities for portable HF antennas for QRP and QRO work in the field.

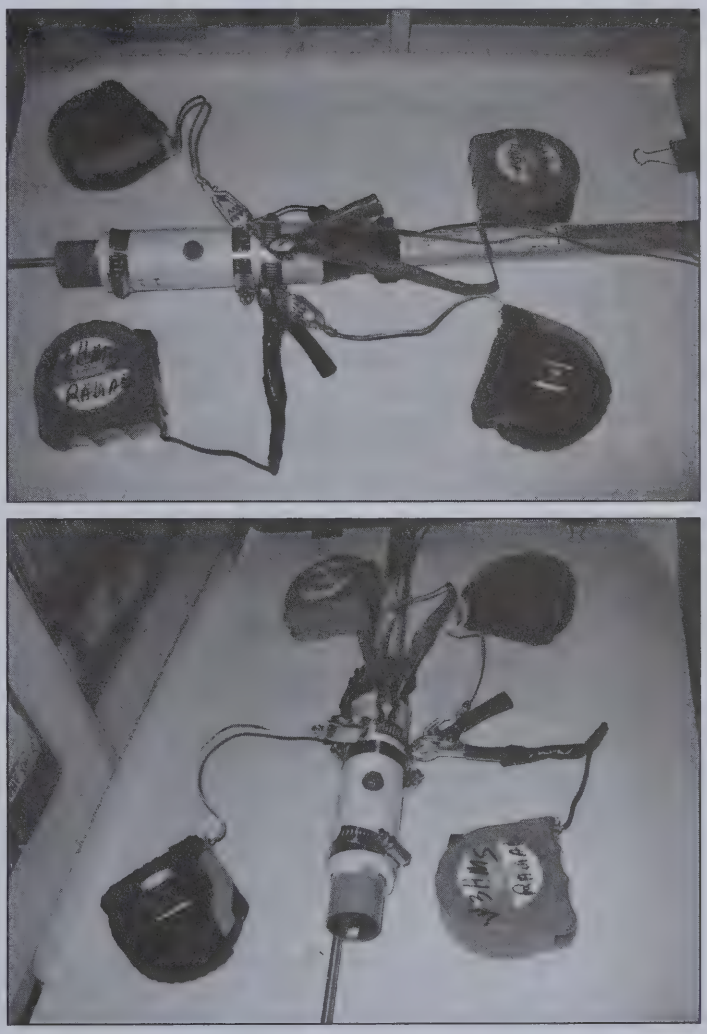
I have seen measuring tapes used in 2 m FM transmitter hunting antennas but the idea came to me of trying one good tape on a vertical antenna. It was easy to deploy out to 16 feet and then connect to the ground position on the antenna with an alligator clip. When I found Harbor Freight selling 25 ft. tapes, 1 inch wide, for about $4.50 each, I bought 4 and soldered a short lead to each one with an alligator clip on the end.

These are so very easy to deploy by just clipping on to a ground ring on the antenna and walking out to 16.5 ft for use on 20 meters. We note also that my 17 ft aluminum golf ball retriever antenna will tune up well on 15, 17, 30, and 40 meters with an Elecraft 20-watt auto-tuner.

I think the accompanying photos speak for themselves as to the ease of use of the antenna and the radials. A tape offers so much more radial surface area than does a wire. If a wire is 1/16 inch in diameter and a tape is 1 inch in width, then the surface area is many times greater than the wire.

As to my agony in untangling wires, I know the Black Widow verticals that use a 20 ft. crappie fishing pole work very, very well on 20, 30 and 40 m. I know that they require 4 bundles of 3 wires each (at a minimum), hence 12 wires in all. The first time I used one was also my last time in using one due solely to the tangling of wires that added many minutes to the quick set up time for the crappie pole itself, not to mention my disposition, HI!! This was the start of my hunt for that to me was to be a better way for radials.

Oh, the golf ball retriever was a great theoretical idea... the golfer pulls this telescoping device with a cup on its end from his golf bag and gravity holds it extended into the pond with clear water. The golfer simply puts the cup under the ball and it is his. Some minor issues arose: many ponds always have dirty water, in ponds with clear water, the movement of the pole stirs up the dirt and vision is lost. And if that isn't enough the vision distortion caused by water renders this apparatus a commercial failure. Thus, mine cost $10 on sale, HI!!



Two views of W3HMS' measuring tape radials.

Designing and Building Your Own Gear

Mike Bryce—WB8VGE

This article was a presentation at FDIM 2018. We wish all the author's live commentary could be included, but we're certain you will find it useful and informative nonetheless! —Editor

Building my own stuff has been the attraction that got me to drink the ham radio Kool Aid. I like soldering a pile of pieces parts together, and end up with a gizmo that may help me communicate with other people.

I've been melting solder for over forty years, so it's quite impossible to pass on every skill and mistake I've made over the years. I'll highlight some of the important stuff.

You Need a Plan

As corny as that sounds, you really do need to sit down with paper and pencil and draw out, plot out, scribble some notes, and makes some record of what you're planning on building/designing. I can absolutely assure you that if you don't, five months later you'll forget what wire did what. What ICs did you plan on using and so on and so on. I used to make fun of people that kept notes until the day I forgot what I did on a large project assembled on perf-board.

Keep a Journal

I use a graph style notebook. They're about $2 at Walmart. With pencil in hand, I begin to draw out what I think I want to do. It sure won't be the final version, but it's my idea on paper. The very first thing you need to do after you have your notebook is to name the project and add the date. It's kind of neat to go back through your notebooks ten years later and see what you were thinking. You'll be surprised how your designs change as you acquire more experience as you build more equipment.

This is important, too: Don't tear out or erase your mistakes either. If you make a notation that this circuit does not work, you won't try and build it again months or years later. Sometimes the misses are more important than the hits. It's quite true—we do learn from our mistakes.

The notebook is a great place to do the math as they say. I use the page opposite the circuit I'm working on to do the calculations needed. I record the values I've used and the necessary changes to the circuit as the project moves along.

Recycle, Recycle, Recycle

I'm not talking about pop cans here. Recycle snippets of circuits that are proven winners. I'm thinking about power supplies. One of the best inventions in the world was the three terminal 1A voltage regulator-the LM78XX series. Why in the world would you want to design a series regulator using discrete parts when a single three-legged gizmo will do it all—and more.

Ten Tec used the same, or a close version of, the SWR/ALC pick up circuit since the Triton 1 up through the Omni VII. Why? Because it worked and worked well. They, the engineers, were comfortable with the circuit and knew precisely how it worked.

Bob Drake of the Drake radio company loved to drop the voltage from his screen supplies down to +12 V or so to run the few solid state circuits. Why didn't he use something else? The way he did it worked so well for all those years, why change?

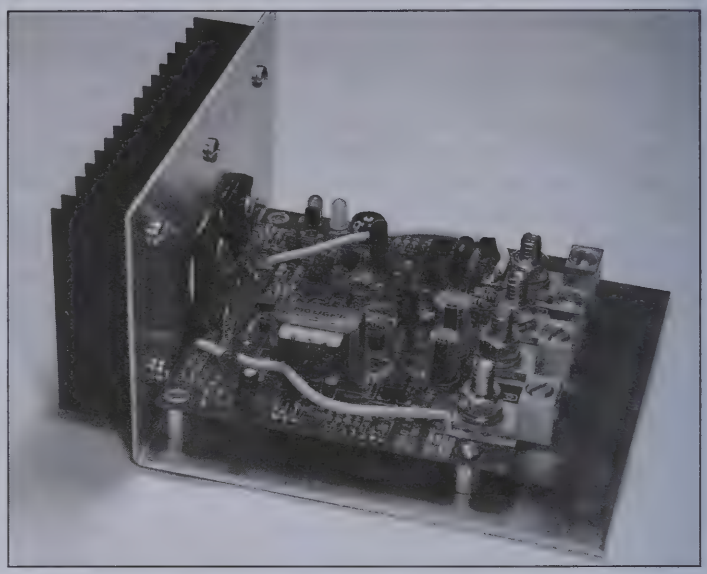


Figure 1—I love to design and build solar charge controllers.

Don't Reinvent the Wheel

I was working on a solar charge controller and the nominal system voltage was 48 Vdc. Fully charged the battery bank would be close to 60 V dc. I had to regulate that voltage down to something the logic could handle. Even my 1A regulators were not up to the task. There was simply too much power to dissipate. Early calculations showed that the regulator would have to drop nearly 50W; an unacceptable amount of power. I needed a buck-buck converter. As it turned out TI had several ICs to choose from as

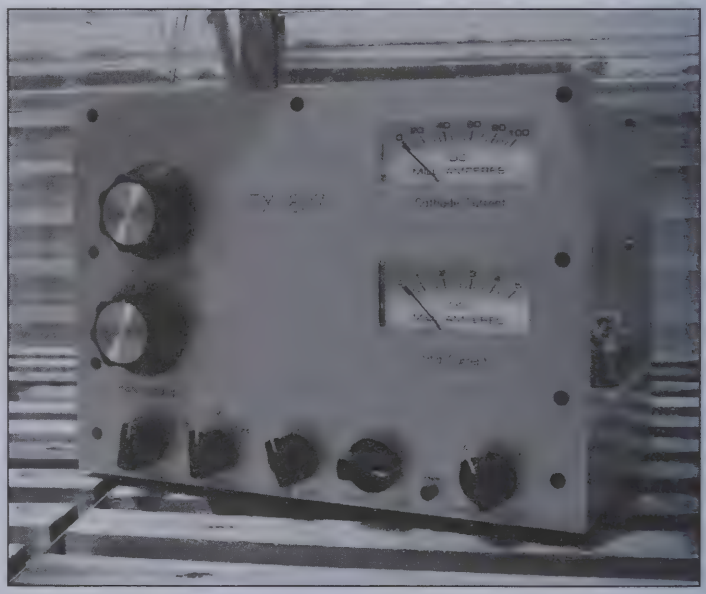


Figure 2—One cannot live by solid state devices. Sometimes you need to see the tubes glow.

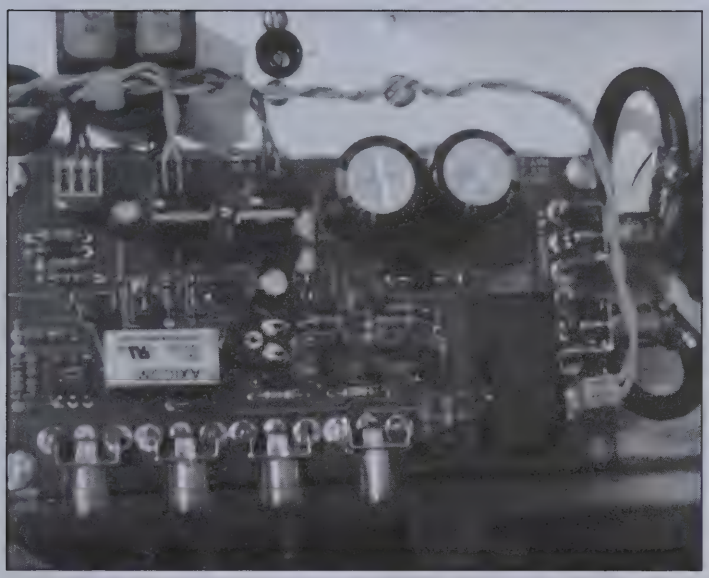


Figure 3—This T/R controller switiches antennas, generates sidetones and keys transmitters.

Figure 4—This little project started out as a sketch on the back of an envolope.

did other vendors. But there was still an issue. Most of them topped out at 48 V max input and I had 60. What to do?

I build a pre-regulator that took the 60 V and reduced that to 50V, I still had some heat to get rid of, but not 50 W. Then I found myself up against the buck-buck converter.

There are quite a few extra parts that are needed to get one of these ICs to work. As it turned out, the chip itself was about $4, and when you added all the other parts together, I would have a ten-dollar bill in the converter.

The Chinese to the Rescue

As it turned out, while surfing Ebay one night, I found that the very same IC sold by Mouser Electronics could be purchased as a fully assembled and tested module that was good for 3A. They were $2 a pop!

The Chinese have made small pcbs for just about anything you can think of. It may take some time to find, but they're out there. One example is the common LM386 audio amplifier. The chip here costs about $1.50 yet you can get an assembled module ready to go for $.99 with free shipping. I'd go as far as to say you could assemble a mono-band receiver using nothing but Chinese made modules/assemblies from Ebay.

The Down Side to Chinese Parts

Just because is says LM7812 doesn't mean it's the real thing. It's buyer beware. I've ordered huge amounts of parts from Chinese supplier and most have been okay. Some were out and out scams, so you must do your homework when buying parts, especially solid sate devices from China. One final note about Chinese parts. Don't buy high power RF transistors from China. 90% of them are cheap knockoffs.

Parts is Parts

There is nothing quite as frustrating as building something and then you find out you don't have the part you need. Been there, done that.

I understand you can't possibly stock every part ever made, and neither can I, but I do have a huge part inventory, which means I can't find what I'm looking for most of the time. I don't have the room to store every small part in its own location. I've narrowed things down so when I need a Zener diode, I may not be able to locate the 3.5 V one, but I can at least know what container has the Zener diodes and only Zener diodes. I do the same with transistors and ICs. Resistors I try and keep them in compartment type storage containers the type used by fishermen to hold tackle. The most common values I keep in bins on the wall by my building table.

When I'm working on a project, sometimes I'm waiting on parts, and thus the entire project gets its own box or container. Inside the container will be any special parts, odd-ball resistor values and miscellaneous hardware that is specific to the project.

Nearly 70% of my purchases come from Mouser Electronics, with Digi-key coming in second. Sometimes I order parts from Newark Electronics and Jameco Electronics. I avoid using surplus parts in my design. Why? Well it's simple. They're surplus. They're not being made anymore. If I want to make more than 10 units, I may not be able to find the part on the market, after all they are surplus.

Let's say you need a 51.1K 1% resistor. You only need one. I order 100. They are less than $.02 each. At Mouser, 100 pcs would be $1.80. If you were to order 10 pcs, then the price is $2.50 because they charge a quarter each in small lot orders. Do the math. Ten for two-fifty or 100 for less than two bucks?

I do the same with solid state devices, too. Transistors are cheap, the 2N4401s that I use are about .03 each when ordered by 1000 at a time. I go though a lot of these transistors.

Although we all order parts by value, another factor is vitally important and that is the physical size. Will the part I ordered fit the pcb? This problem more than any other has bit me in the butt.

Surface Mount Devices

As it turns out, all the newest chips with the neatest features

Figure 5—Sometimes I buy other people's homebrew rigs. This is an AM transmitter for 160 meters.

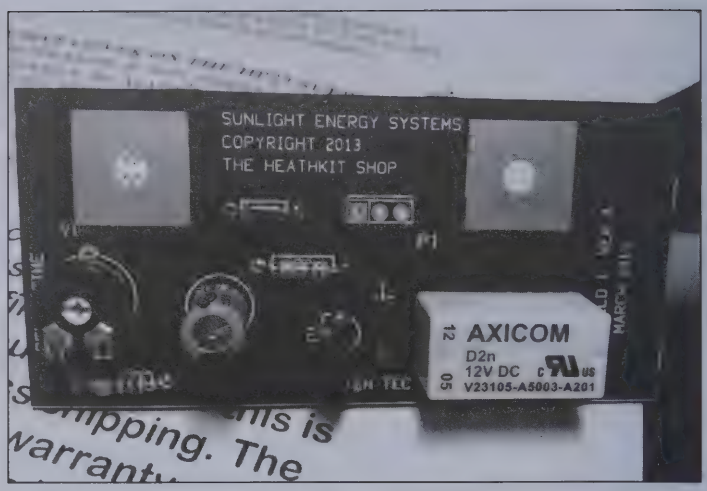


Figure 6—Sometimes I build things not made by the factory any more. The little pcb is for the Ten Tec Argosy and is used to key an external amplifier.

are now coming out in SMD-only footprints. It's making building much harder, especially for us old guys.

You might as well jump on the wagon. Working with SMD is not much different from though holes parts. They're only smaller, in some cases much, much smaller. For most of us, the smallest footprint that I use is the 1206. At least that size you can still see with the naked eye. The smaller stuff, you'll need a microscope, or some sort of viewing device. I've found my magnifying glasses don't help me much.

When you think microscope, don't think you need 100X or 500X magnification. You don't. Most of the time, a 10X is more than you need.

Don't cheapen out and get several good tweezers. Not the ones your wife uses to plunk her eyebrows with either. You need tweezers designed for SMD work. The good ones are not cheap. Plan on spending $40 for a good one. Some tweezers go for hundreds of dollars.

Soldering can be an issue. I use a cheap Chinese hot air gun and that works great. If I need to solder more than ten pcbs of the same circuit, and I have a stencil, I'll cook'em in a small toaster oven to reflow the solder.

SMD resistor (1206) and ceramic capacitors, diodes, are easy to hand solder. The transistors get iffy, and LEDs are hateful—they are easy to cook with too much heat. Electrolytic capacitors are very hard to solder due to the way they mount. You can't get underneath them to heat the pads.

Perf-board or PCB?

I haven't put a circuit on perf-board in decades, and I'm not about to restart the habit. I use pcbs. I happen to like designing pcbs.

There is not enough space here to go into the details of pcb layout. That being said, there is one thing that I do that has saved my buns from the flames, and that's to print out the silkscreen and verify that all the parts fit. You'd be surprised how many times I've had to move a resistor lead because it would hit a mounting screw or a heatsink. I'll add that it takes practice—don't expect to make perfect pcbs right away.

Ah, the Metal Work

I'm no machinist... That doesn't mean I don't have the correct tools. It means I lack the skill set. At a minimum you'll need some measuring tools. I'm not talking about a yardstick or a 30' tape measure either. I use several precision measuring devices. They're expensive and you can pick them up at the big box stores.

Other tools are small machinist squares, files, both bastard and mill, and transfer punches. Every project requires drilling holes, so a good set of drill bits really comes in handy. However, even the best drill bit won't make a perfect hole in most metals. For those, I use what are known as a stepbits. Some people call them 'unibits' but they do the same thing and that's drill nice holes into metal. Of course, each one has various steps or sizes that you can simply push into the material. A word of caution should be said, as a sharp unibit can easily open up the hole larger than you're trying to make. Don't be tempted to use a cordless (or corded) drill. To get the best results, use a drill press. I have one that is quite small and does 99% of the work I've asked it to do.

One of the hardest things to do when building your own gear is drilling two or more holes in a straight line. I don't care how well you measure, how hard you smack the center punch into the metal, one slight offset with the drill bit and when you're done, your eyes will instantly see one or more of the holes you drilled is off line.

Square or rectangle cut outs are hard to make, and I never make more than two in a row. Same problem as above. All the cut outs have to be made with files, unless you happen to have the necessary punches. Square punches are dear to pay for, however specialized ones are a Godsend when you want to put in a DB-9 in your panel.

Transfer punches come in various sizes. They are used to automatically find the center of the hole, and the sharp tip that allows you to smack the end and of the punch into the metal. Then you drill out the hole. When I mount a pcb, I normally have several and stack them into one, use the transfer punch and find the center of each hole. Then I drill them out.

After years of trying to bend metal, I purchased a cheap metal brake from Harbor Freight. I think I paid less than $10 for it, and

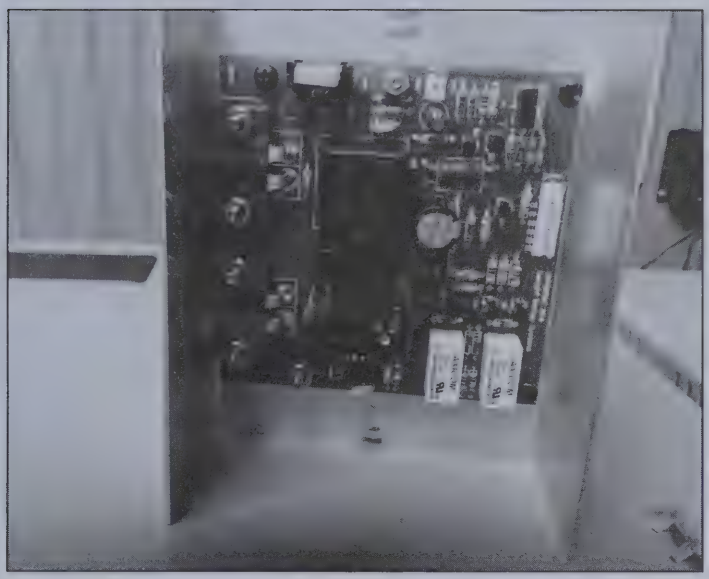


Figure 7—A solution to over-current. This project goes between the power source and your radio.

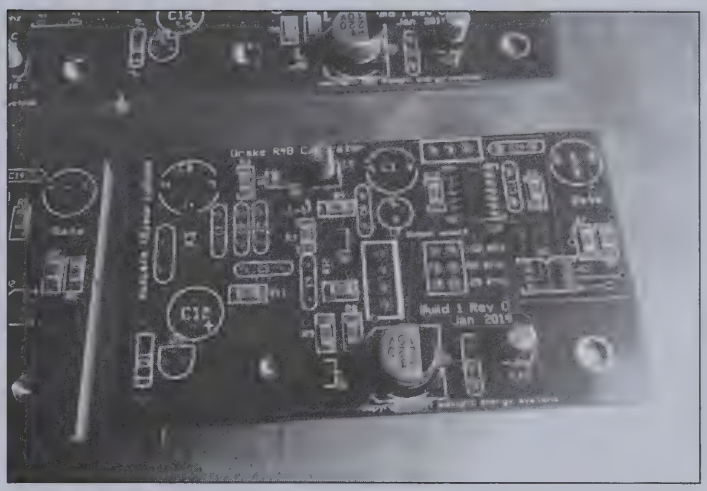


Figure 8—Here are some calibrator pcbs for the Drake R4B with SMD parts and solder paste, ready for the oven.

thats why it takes ten minutes to set up to make a single bend. I have used it to bend .125 thick aluminum, but I wouldn't make a habit of doing that with this brake.

I have been experimenting with clench nuts and standoff. These are known by the trade name PEM. They are metal displacement mounts. They work by pressing them into the metal and allowing the metal to cold form around the insert. It takes at least a two-ton press to squeeze them into place. Nope, you can't use a hammer, the striking time is way too short to allow the metal to flow.

Once more, Harbor Freight came to the rescue and $50 later I'm bolting a arbor press onto one of my work benches. It's a tad light, I'd like a 4-ton unit, so I use a torque multiplier (a long hunk of pipe on the handle) and I've had no issue pressing the hardware into the metal.

PEM fasteners require a die. The die goes under the nut or standoff/stud and you squeeze in the part from above. I found that by using a small quarter-inch drive socket that just barely clear the part, I've been getting excellent results. The only problem I'm having is the arbor press is a bit too small, and I can't press hardware into a cabinet that won't fit inside the press.

There is one more important bit of information about using PEM hardware that I need to pass on. You need to drill a hole that is correctly sized for the piece you're installing. Most of the common drill sizes you can get at a big box store won't have the correct size. And nope, you can't use what is 'close' as it won't allow the metal to flow correctly. I found you can purchase all the drill sizes you need at Macmaster Carr or other large industrial supply houses.

One can purchase the PEM hardware from various sites online. Of course there are knock-offs and they are much cheaper. I've had success using those as well. Search Ebay for "clenching hardware".

Wiring Things Together

I absolutely hate seeing a wad of wires coming out of a pcb. I use MTA connectors with a spacing of .100" or .156" on all my projects. Unless I'm dealing with high current/voltage, I use a connector.

I've more or less used my own standard with color codes. Red is normally positive voltage, while blue are control voltages. Black and brown are grounds. Yellow wires carry logic. Of course, that's not carved into any rocks that I know of, and I've been guilty of not following my own color codes, especially when I'm out of the correct colored wire.

Most of the connections form around the outside edges of my pcbs. However I've leaning toward breaking my own rule and allowing myself to place a connector anyplace on the pcb where it is needed.

Using nylon cable ties will be up to you. I normally don't, but that's just me. Sometimes I use all the same color wire (they all might be control lines) and when you squeeze them all together with cables ties, it's impossible to track down a single wire.

The Final Home Stretch

I've started to use washers with my hardware to keep things from falling apart. However, it seems that I never ever seem to have enough washers on hand to do the job.

I do order large batches of 4-40, 6-32, 8-32 hardware from Macmaster Carr, they're much cheaper than the big box stores and the hardware stores. The selections Carr carries boggles the mind. I had no idea the number of different types of 6-32 nuts there are. Perhaps I should order in more washers?

Tidy up any loose pieces parts, and finish up by updating your notebook. I'm sure things have changed from the beginning of your project to completion.

Making it Look Nice

Am I glad the days of Dymo labels have come and gone. Nothing made a project scream homebrew than a front panel covered with those labels.

I normally use one of two ways to make labels for my project. I make a custom front panel by engraving the letters into the aluminum. For that I use free software from Front Panel Express. They're certainly not cheap and I only use them on rare occasions.

Figure 9—Backside view of a PEM standoff pressed into a sheet of metal.

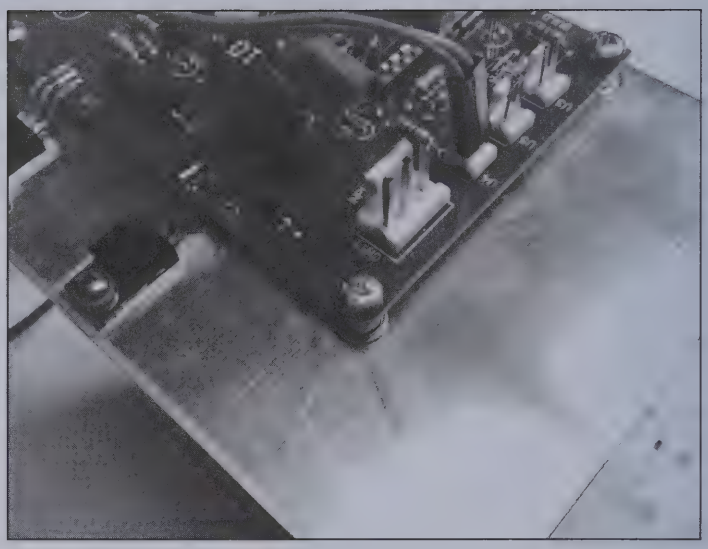


Figure 10—Top view. Notice the ring around the standoff. That's from the socket I used as a die. Worked great.

The much cheaper method is to use water slide decals. Online you can purchase sheets of decals that you can print on with either a laser or ink jet printer. You can't use the ink jet decals on a laser printer, and vice-versa the laser printer labels on an ink jet printer.

The process is simple. I use Microsoft Word to make the labels. Then print them on regular paper that I've cut to match the case I'm working on. I adjust the spacing, text size and whatever else I need to do to get the desired look. Then I slip in the decal paper and print.

After the ink has dried, a quick thin layer of clear lacquer is applied. I use Krylon crystal clear. It's best to use several thin layers than one thick one. It takes a day or so to do this, allowing for drying time between coats. When you're ready to apply the decal, follow the directions that came with the sheets.

Normally, when I print out a sheet, I fill it up with common names such as power, output, volume, and such. That way I have some ready to go decals at a moments notice.

The only problem I see when using decals are the edges are visible. To get around that problem, if the project is small enough, a decal the size of the entire front panel is made. That way, you can't see the edges.

There is one last item, and that's to write up your project and send it in to the *QRP Quarterly*... I might want to build one for myself!

●●

The Ultralight Portable Antenna Quest

Charles Bushell—KC8VWM

John VE3IPS: I came across a wonderful antenna idea that would suit a QRP builder to make on a rainy weekend. I did a very ugly build out with just some wire, tape and a Buddipole whip so feel free to experiment. Charles has agreed to share his article. The complete article with larger photos for your reference is at:

https://forums.qrz.com/index.php? threads/ultralight-portable-antenna-quest. 570836/

https://www.youtube.com/watch?v= QjI2AHK2t4U

The antenna design criteria is to construct a portable ultralight vertical antenna suitable for SOTA or backpacking in the wilderness.

1. The antenna must be very lightweight. Under 1 pound !
2. The antenna must be very small in size to carry around and take up very little space.
3. The antenna must cover at least 9 bands and must perform very effectively and efficiently.

Introducing the Portable Ultralight Multi Band Antenna

Not much larger than 3 dollar bills long, this antenna will cover 2m through 40m and will perform very efficiently on all these bands. It will be the perfect portable antenna companion for an FT-817 while travelling anywhere. This antenna is a full 5/8 wave antenna on 2m and 6m bands for maximum gain and performance. It is a full sized 1/4 wave antenna on 10 and 12 meters. (No loading coil needed)

So how does this small portable antenna fair in terms of efficiency on bands like 14 MHz though?

Not bad at all really (see Table 1). We are going to use this antenna as an inverted L configuration on the 40m band so efficiency should approach 90% (more on that later.) So how does this antenna meet our criteria as a lightweight portable antenna?

How it Works

For 2m operation the antenna element is telescoped to 4' (5/8 wave long) and the coil is used as a matching network for the antenna. The antenna taps are movable to achieve the best SWR reading.

On 6m the antenna element is extended to 1/4 or 5/8 wave long and the coil is tapped and used as a matching network.

On 10 meters the very top section of the telescopic whip is collapsed and not used. This is now a full sized 1/4 wave antenna. The coil is entirely bypassed by joining the red and blue wires together and this provides a less than 1.5:1 SWR on 10m. [The blue wire goes to the coax connector, and the red wire

For operation on 12,15,17,20 and 30m you tap the coil at various locations marked on the coil (Figure 2):

- The blue wire remains at the same location for all bands but it remains adjustable if desired.
- The red wire connects taps at the yellow paint mark locations on the coil to work other bands down to 30m.

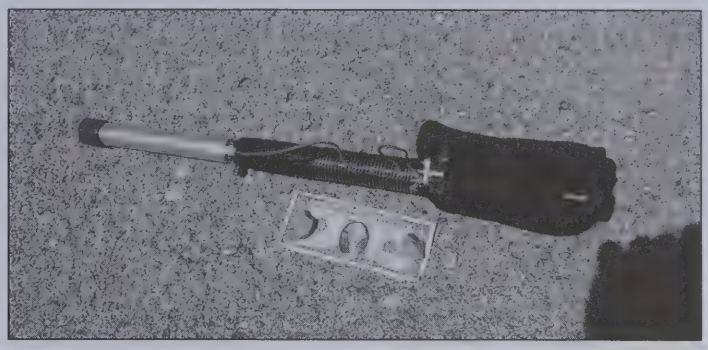


Figure 1—The antenna in its retracted position, easy to carry around.

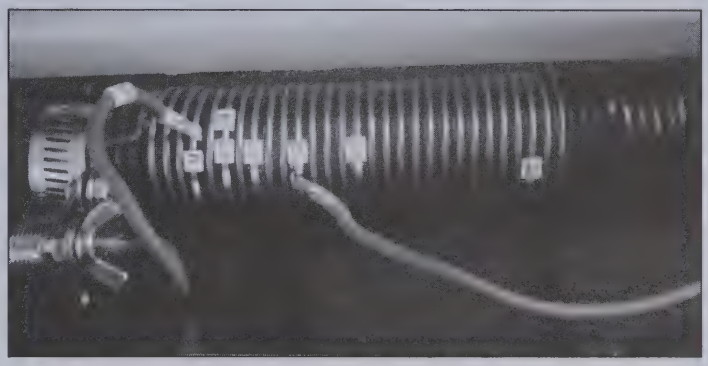


Figure 2—Close up of the coil and taps.

- On 40m you tap the coil at the "40 / 12" spot and attach one of the radial wires approx. 20 ft. long to the top of the antenna and then run it in an inverted L configuration away from the top of the antenna. This provides an SWR of 1.2:1 on 7.200 and 2:1 at 7.050.

Construction of the Antenna

The antenna is based on a lightweight fishing pole design approx. 12' long. Carefully remove all the fishing line guides from the pole sections as we will no longer be needing them. They are glued to the fiberglass rod and will break free if carefully rocked back and forth. Then remove the cap at the bottom of the fishing pole and remove all the individual telescopic sections and put them aside.

Next remove any metal clamps typically used to hold the fishing reel in place on the fishing pole handle. A Dremel tool or sim-

F (MHz)	C (pF)	R_r (Ω)	Impedance	Efficiency	L (uH)
1.8	30.1	0.146	13.72 –*j*2716	0.01064	240
3.5	30.6	0.55	7.43 –*j*1375	0.074	62.5
7	32.8	2.2	7.04 –*j*644	0.312	14.6
10	36.5	4.5	6.5 –*j*408	0.692	6.49
14	46.5	8.8	10 –*j*232	0.88	2.64

Table 1—Performance data for a 10.5 long whip antenna. This information is from the *ARRL Antenna Book*.

Figure 3—The split-loom tubing (top) and a magnified view of the finished winding (bottom).

ilar method can be used to cut them off the pole handle.

The Inductor coil is going to be wrapped on low cost (and lightweight) automotive split loom tubing. When completed, the wound coil should look like Figure 3.

The fishing rod handle itself is going to be used as the coil form. Place the automotive loom tubing around the fishing pole handle. This will result in an approx. 1" diameter coil. Wind 30 turns of #14 AWG bare solid copper wire around the split loom tubing. (Room remains available to add more coil turns if desired.) You can run some hot glue along the coil to hold it in place to prevent it from slipping out of the automotive loom tubing grooves.

Next we install an SO-239 connector on the fishing rod handle (Figure 4).

There is a small piece of aluminum which is bent into an L shape. It is screwed directly to the SO-239 connector and then the other side of the L bracket is placed under the hose clamp as shown in the photo. This holds the connector quite securely in place.

Figure 5—Use flexible wire for the jumpers.

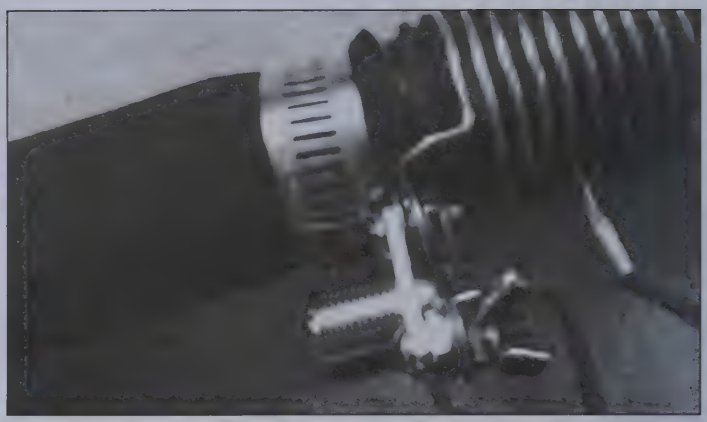


Figure 4—Installation of the SO-239 coax connector.

Next connect the end of the coil wire to the SO-239 connector. Install a screw and some washers and then connect the coil wire between the washers on the screw as shown below.

Install another screw on the SO-239 connector and install a wing nut as shown above. This will serve as your antenna radial attachment location. Solder the blue wire to the center pin of the SO-239 connector. I am using a curved blade connector from an Anderson power pole as a coil tap, but you may decide if an alligator clip would work better.

The wire chosen for the tap should be "rubbery" and very flexible. Avoid using stiff wire for your coil taps. The length of the wire should be long enough to reach the entire length of the coil (Figure 5).

Tuning the coil depends on your particular fishing pole length and other factors. It is primarily done by experimenting with tapping different locations on the coil. When you find the sweet spot on the coil for the desired band, achieving the best SWR, then mark it with a paint marker.

The red wire is attached to the telescopic fishing pole side using a hose clamp. But wait a sec... the fishing pole is made of fiberglass and this doesn't make any sense at all though?!?!

Yes it does and here's why...

Remember those individual pole sections I told you to remove from the bottom of the fishing rod and put aside for later?

Well those fishing pole sections are going to be individually wrapped in aluminum tape as shown in Figures 6 and 7.

It is required to cut the aluminum tape using a box knife to size

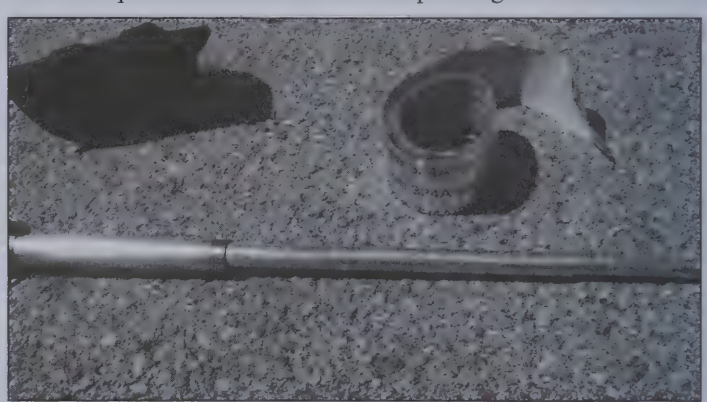


Figure 6—Aluminum tape is used to make the fiberglass rod sections conductive while keeping things very lightweight.

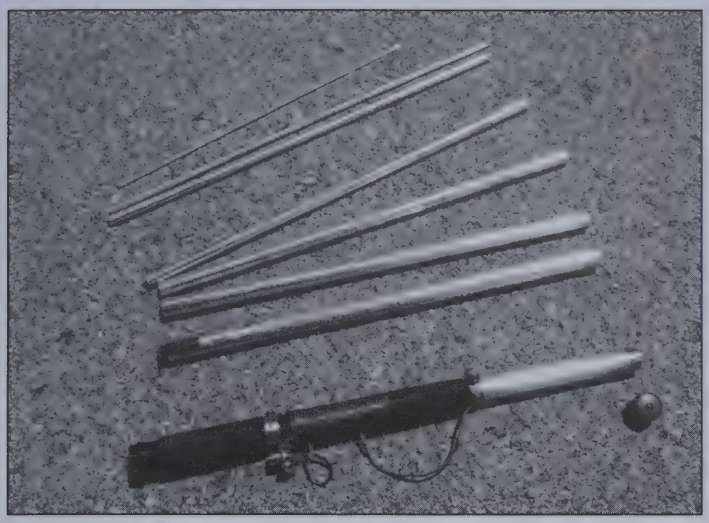


Figure 7—The sections are all taped and ready to become a telescoping whip.

the tape for a good fit. Carefully wrap the tape on the fiberglass tubing sections ensuring there are no wrinkles in the tape. It helps to use a cloth to rub the tape perfectly flat. It's a little bit like installing window tint on glass, but I completed all the sections in a little over an hour.

Be sure to fold over a little bit of aluminum tape on the inside of the fiberglass tubing at the ends of each section. This will ensure electrical conductivity occurs throughout the entire telescopic antenna.

Figure 8—The complete "aluminized" pole.

What you have now is the world's lightest all aluminum telescoping antenna! Figure 8 shows the finished antenna.

So Now We Need Radials

The wire I am using was extracted from a 6 conductor telephone extension cord. This wire is really flexible and won't tangle very easily. Telephone wire is actually very easy to work with because of the high strand count. So I made up 6 antenna radials approx. 22 feet long to use with the vertical antenna.

The bag attached to the handle as seen in the first photo is intended for safety glasses but it was re-purposed for holding all our antenna radials inside. It could also contain printed setup instructions for using the portable antenna if you like.

So there you have it... An ultralight multi-band portable vertical antenna you can only build yourself and money can't buy.

S- Meter Levels

RF Engineers define S9 on the HF bands to be a receiver input power of –73 dBm. This is a level of 50 μV at the receiver's antenna input assuming the input impedance of the receiver is 50 ohms. The difference of one S-unit corresponds is defined as 6 dB, or a power ratio of four. Thus a 5-watt signal needs to be 20 watts to raise the S meter by 1 unit. To help with calibration, a unit like the Elecraft XG2 can be used. The XG2 is a fixed-frequency signal source with switch selectable oscillator frequencies on 80, 40 and 20M. It has accurate 1 μV and 50 μV output levels that can be used to test your receiver and align your S meter. *—de VE3IPS*

A Day Trip to ARRL HQ

John Leonardelli—VE3IPS VE3IPS@gmail.com

On recent business trips to the Hartford area I had the ability to drop into ARRL HQ for tours and operate the W1AW stations.

My recent visit gave me a great opportunity to meet Ed Hare, W1RFI and Zachary Lau, W1VT (ex-KH6CP) who work at ARRL.

I got to hear the wonderful story how Doug Demaw's Tuna Tin ended up in a hamfest bin for a $1 and found its way back home. For me this project got me super excited and got me started into QRP and building things that transmit, listen or radiate.

After washing my hands several times, I was able to hold the kit and feel the QRP energy.

The showcase in the photo below holds lots of QRP projects over the years and is a museum in itself.

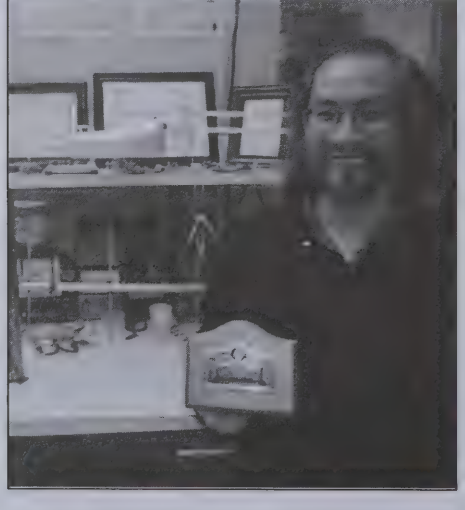
I strongly urge all ARRL members to visit HQ when in town and get a tour of the premises and learn a little about the "old man", see his station and chat up with staff to further enrich your understanding of our great hobby.

Here are sources of more info:

http://www.arrl.org/files/file/Technology/tis/info/pdf/7605014.pdf

http://www.arrl.org/files/file/Technology/tis/info/pdf/0003037.pdf

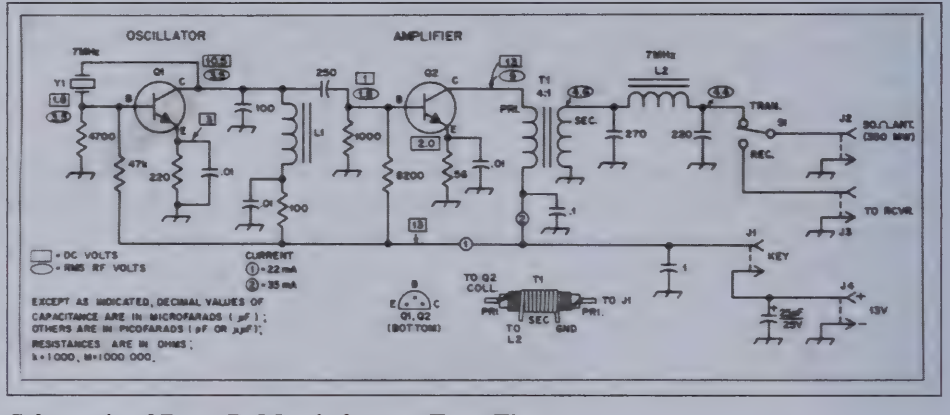
http://www.qrpme.com



Zachary W1VT enjoys G-QRP.

John VE3IPS and Ed W1RFI with the original Tuna Tin.

The Tuna Tin also posed for a close-up photo.



Schematic of Doug DeMaw's famous Tuna Tin.

The display showcase at ARRL Headquarters includes a lot of QRP history.

Cheap HF Quarter-Wave Stubs

Al Duncan—VE3RRD

You might ask "why would I need a quarter-wave stub?" When our club is activating a lighthouse, beach or park, we are often setting up two or even three stations with antennas in fairly close proximity to each other. Although some stations may be QRP, many times we are also including a 100W transceiver for SSB.

This can cause major interference between stations, even when everyone is on a different band. For example, a transmitter on 40m (7 MHz) can overload a receiver on the 20m (14 MHz) band, making it almost impossible for the 20m station to copy CW or even voice.

A shorted quarter-wavelength (for a particular frequency) length of coax will appear as an open at the other end of this shorted stub. For example, if we make a shorted stub for 20m and connect it to the transceiver, it will not affect the SWR on 20m but will appear as a partial short to signals on the 40m band. This is because the 20m quarter-wave stub will appear as an eighth-wavelength shorted stub on 7 MHz and will greatly attenuate these signals. Likewise, also placing a 40m stub on the 7 MHz station can greatly reduce any harmonic RF it is producing on the 14 MHz band.

You can use a regular T-connector (either BNC or UHF as required) attached directly to the transceiver, with the antenna coax connected to one side and the quarter-wavelength shorted stub (for the band you will be operating on) connected to the other side of the Tee.

After searching the internet and reading several articles on the difficulty of making precision quarter-wave stubs out of expensive 50 ohm coax, and placing them in precise locations on the station feed line; I almost gave up on the idea of trying to make my own.

The fact is that a multiband antenna is not always 50 ohms on every band, and a transceiver's internal tuner can compensate for mismatches that may be introduced by the antenna or by attaching a quarter-wave stub. Since I didn't plan on using a kW, I figured any small coax should work for QRP levels. And not necessarily 50 ohm coax, I had lots of quality 75 ohm RG6 satellite TV coax laying around. I put an F-connector on the RG6 and then used an F to BNC adapter.

I cut the RG6 for each band, using the formula (468/MHz)/2 to find the length in feet. I didn't know the velocity factor for my RG6 so I multiplied the result by 0.9 which made it a bit long.

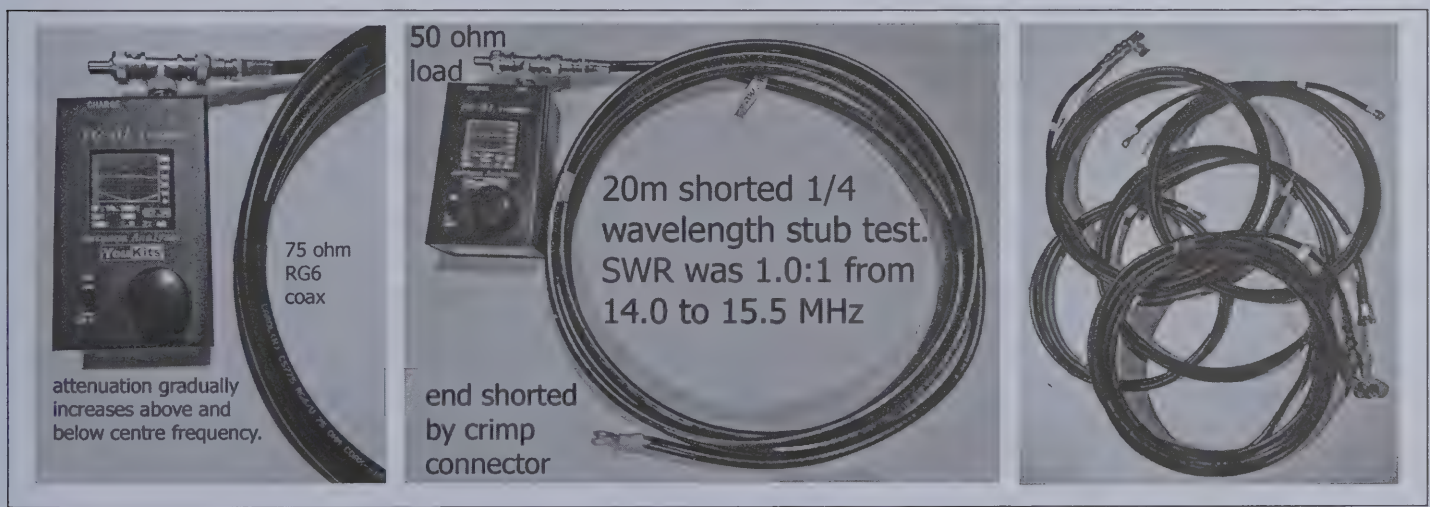
My little YouKits FG-01 antenna analyzer made it very easy to trim the coax to the proper frequency. It can visually display the center frequency for an open quarter-wave stub in real-time also, so I just kept cutting off an inch or so at a time until it looked good while attached to the T-connector along with a 50 ohm load. Then I shorted the center conductor to the shield braid at the end and used a crimp-on lug, its tab can be cut off and heat shrink used to insulate the end of the stub if desired. After shorting the stub, the exact 1:1 SWR bandwidth can be measured, with a 50 ohm load where the antenna will connect.

Everyone in our group has made a stub for each of the various HF bands they plan on using when we are operating together. I have found that these stubs even work well on the club TS-480SAT at 100W, and have also used them on my KXPA-100 PA when operating my KX3 at 100W. I used a UHF type T-connector on the transceiver/PA output and then used a UHF to BNC adapter to mate to the stubs.

When everyone is on a different band and all are using their quarter-wave shorted stubs, interference between stations has been greatly reduced (and in many cases, completely eliminated). Also the stub tends to attenuate out-of-band signals from other (non-amateur radio) sources.

My version is cheap, easy to make and works well for us. This project proved to me that it's better to try it and see if it works, rather than just accept that the "experts" say it probably won't. Total cost was very low—half a dozen type F crimp-on connectors, one or two F to BNC adaptors, a BNC or UHF Tee, and a UHF to BNC adaptor if needed; the RG6 coax was free.

I made a set of 5 quarter-wave stubs for the 10, 15, 17, 20 and 40m bands. I plan on also making one for the 80m band. These are compact and lightweight, and all fit into a small bag (wind some in diameters that can nest inside others). Don't forget to label each stub with the band it is for, as you make them. We will definitely be trying them out during the next Field Day with two 100W club stations, one is on SSB and the other on CW or a digital mode. ●●



FT8 SOTA Activation

Burke Baumann—KF7NP

As a new SOTA activator I am continuing to experiment and learn with each activation. On my first activation I tried to include FT8 operation with my 2m FM and HF SSB operation as my CW skills are nonexistent. This failed miserably to say the least. There were problems with the communications between the computer and radio. Also, WSJTX and Windows always seem to have issues with the USB audio connection. Activation 10 went the same way a big failure. Both attempts were with Windows 10 and WSJTX V1.9. The hardware was a Rig Blaster plug and play and a USB sound card. Most of the issues were with the Rig Blaster not maintaining communications with the FT-817. I have a second Rig Blaster plug and play that works with My ICOM radios with no problems. It may be a bad unit or something with the FT-817.

Jump forward to my activation of W7A/MN145 using new hardware and WSJTX version 2.0 (Figure 1).

This activation was a total success. The new features in version 2.0 make it much more suitable for use with SOTA operations. The new features allow nonstandard call signs like "Callsign/P" for portable and during the CQ message up to 4 additional characters in the CQ message. I was able to use the following message.

CQ SOTA KF7NP/P DM33

This immediately drew several callers resulting in contacts. This could be used to designate activators to the chasers even if they had not been spotted on SotaWatch. I also believe that signing "/P" attracted callers who tried to work a portable station with a weaker signal. In addition to my 2m FM contacts and 6 HF SSB contacts I was able make 17 FT8 contacts. Included in these were contacts with VE4VJR, KL7YK, JA3BOA and JL1IEO all who worked me with my weak signal when there were plenty of strong stations to work.

I also used a transmit macro with this format for the summit designation in transmit message 5.

W7A MN145 73

Spots on SotaWatch for my FT8 operation did not bring an increase in contacts possibly because there are fewer FT8 operators on SotaWatch.

My biggest issue with FT8 may be the slow rate of contacts. Usually after an SSB spot on SotaWatch I can make 6 or 8 SSB contacts very quickly. The same is true of CW contacts which also occur quickly. The trade off for the slow exchange is the good weak signal characteristics and a large pool of stations to work. These stations are grouped close together with the sole interest in making contacts. They are not there to rag chewing, participate in nets or for schedules. They are there primarily to make contacts possibly chasing countries or grids.

The second change was to my WSJT-X setup shown in Figure 2. A better look at my setup is shown in Figure 3, during testing at home in my back yard.

Figure 1—The portable SOTA station site.

Equipment used:

Radio: FT-817
Antenna: Inverted V
PC: Vulcan Windows 10 tablet with RealVNC client application.
WSJT-X PC: Asus Tinker S Board running WSJT-X version 2.0 and X11VNC server software with TinkerOS (Debian)
Sound Interface: Homemade cable from the Tinker Board Audio Jack to the FT-817 Rear Data Jack
FT-817 Control: Valley Enterprise Yaesu USB FTDI CT-62 cat cable for the FT-817 from Amazon
WIFI: Galaxy S7 with WIFI hotspot enabled
Batteries: Two Power Bank Model YB1206000-USB 6 AH LIPO batteries with USB power ports, available from Amazon. The outputs are over-current protected at 3 amps so they are not suitable for higher power radios.

For this activation I used an ASUS Tinker Board S single board computer running TinkerOS Debian. This is similar to the Raspberry PI with some improvements. First it has a faster CPU to support decoding more stations during busy band conditions. For the decode mode I run Fast or Normal since the calling stations will tend to have stronger signals. The Tinker Board has an audio codec supporting audio input and output at up to 96 kHz with up to 24 bit audio eliminating the need for a USB audio device. I wired the audio directly to my FT-817 rear data port without any transformer isolation since the radio and computer were each powered by separate batteries and no mains supplies are used. This should reduce the possibility of ground loops and noise induced by the ground loops. The audio port on the Tinker Board uses the same 4 pin 1/8-inch plug as on a S7 phone. The S version of the Tinker board also automatically detects that a cable

Figure 2—The portable station.

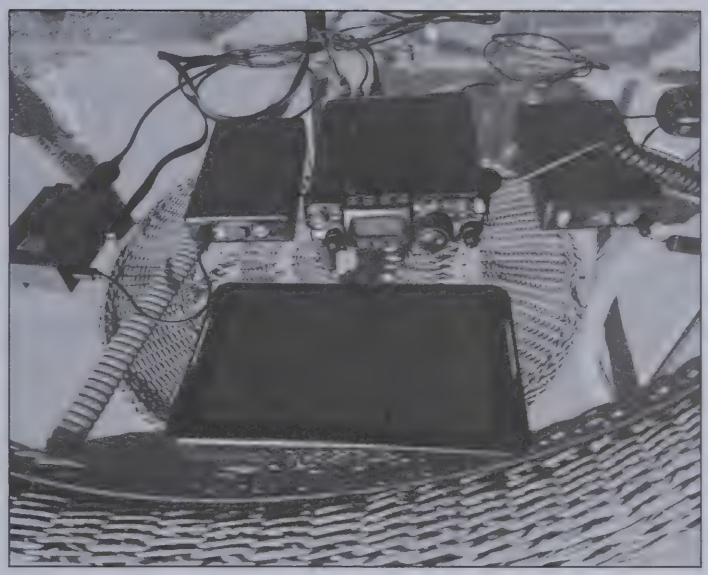


Figure 3—The station set up for testing in my back yard.

is connected to the audio port and directs the audio signals there. It also has 16 GB of eMMC fast flash memory on board. The non S version of the Tinker board does not have these 2 features. The Tinker board is about the same size as my Rig Blaster with less cables and no need for the USB hub and wires.

The Tinker runs a version of Debian Linux. To this I installed the latest version of WSJT-X from the WSJT web site. I also installed X11VNC which is a VNC server which allows me to send the screen display to the Windows tablet. The Windows tablet running RealVNC client acts as the display and input device for the Tinker board. RealVNC will also run on an Android tablet or phone allowing them to be used instead of the Windows tablet or PC. The CPU load on the tablet is very low so the battery lasts a significant amount of time. In the field I enable the hotspot on my smart phone to act a WIFI router. The tinker board and the tablet connect to the hotspot allowing them to communicate over the network to each other. The tinker board also picks up accurate network time to set its clock since it does not have a real time clock. This works fine for most of the 300 summits immediately surrounding the Phoenix area. A GPS can be added when there is no phone coverage. The network connection could also be setup as a direct ad hoc network connection. More information can be found at these 2 web sites which got me to this point in my hardware setup. Both of these individuals have done a great job and I would have been lost without all the great information on their sites. Many thanks to both of them.

This site covers the use of the Raspberry PI and solutions for GPS time sync.

https://oh8stn.org/blog/2018/08/13/x-days-off-grid-radio-raspberry-pi-prerequisites/

I encountered some differences and made some changes to suit my configuration. First I loaded WSJT-X version 2.0 for the WSJT web site. With version 2.0 I did not experience the problem he described with not having Libreadline6 installed and did not edit the package status file. It did complain about another module missing and I just installed it from the repository. Unfortunately I did not write down the name of the module when I did it. I also booted into the GUI interface. There is a configuration menu that allows you to run programs when the GUI (graphical user Interface) starts. I ran the startvnc script file and WSJT-X. Make sure your startvnc script works by trying to execute it from the terminal window. I initially had errors which prevented it from running. With RealVNC on your tablet you want to connect to screen 0. It will be IP address aaa.bbb.ccc.ddd:0.

I hope this inspires others to try WSJT-X during their activations! ●●

Start planning now for FDIM 2019 — May 16-19 in Fairborn, Ohio

How to Simply Add VHF and UHF Capability to Your QRP Station

James Duffey—KK6MC KK6MC@amsat.org

At FDIM 2018, "Dr. Megacycle" KK6MC presented this summary of methods and available hardware for adding VHF and UHF bands to your station. —Editor

While most hams use QRP 2M or 440 MHz rigs in the form of a handle-talkie using SSB, CW, and digital modes opens a whole new world of activity and opportunity for the traditional HF QRP operator. But, many are deterred by the fear of the cost and complexity involved or by the different operating styles encountered on the VHF/UHF bands. I will show simple low-cost and low-hassle ways to add VHF and UHF capability to your QRP station. There are low cost transverters available with good performance. IF switching can be performed with an inexpensive video selector or switchless IF band selection can be performed with slightly more expensive diplexers. Operating techniques are simple to learn and will be discussed briefly.

Introduction

The bands above 28 MHz, what we commonly call VHF, UHF, and microwaves, are a frontier well worth exploring. Many of today's rigs have at least some VHF capability, often 6M. If you have such a rig, use it to get on VHF without further hassle. Although most hams have experience on some of these bands with 2M and/or 70cm FM handie-talkies, fewer have experience with SSB or CW on these bands. While VHF/UHF FM can be quite fun and very useful, it only offers a small glimpse of what these bands are really capable of. The bands offer challenges in weak signal detection, antenna design and deployment, operating skills and knowledge of propagation modes that we are not familiar with on the HF bands. With persistence, a good antenna, and knowledge of propagation, a well equipped QRP station with a good antenna should be able to work modest stations within 200 miles on CW with little in the way of enhanced conditions. Unfortunately many QRPers lack the capability to get on these bands and it can be a daunting technical task to some to get up to speed. That is not necessary. I have written this tome to help the new comer to VHF get on the air simply and with a minimum of expenditure. VHFers are a voracious bunch, eager for new stations to work. So if you can latch on to a local VHF/UHF enthusiast, they are also a source of great knowledge which should be utilized.

Transverters

A transverter is usually the most cost and performance effective way to get on the VHF bands. A transverter is a receive

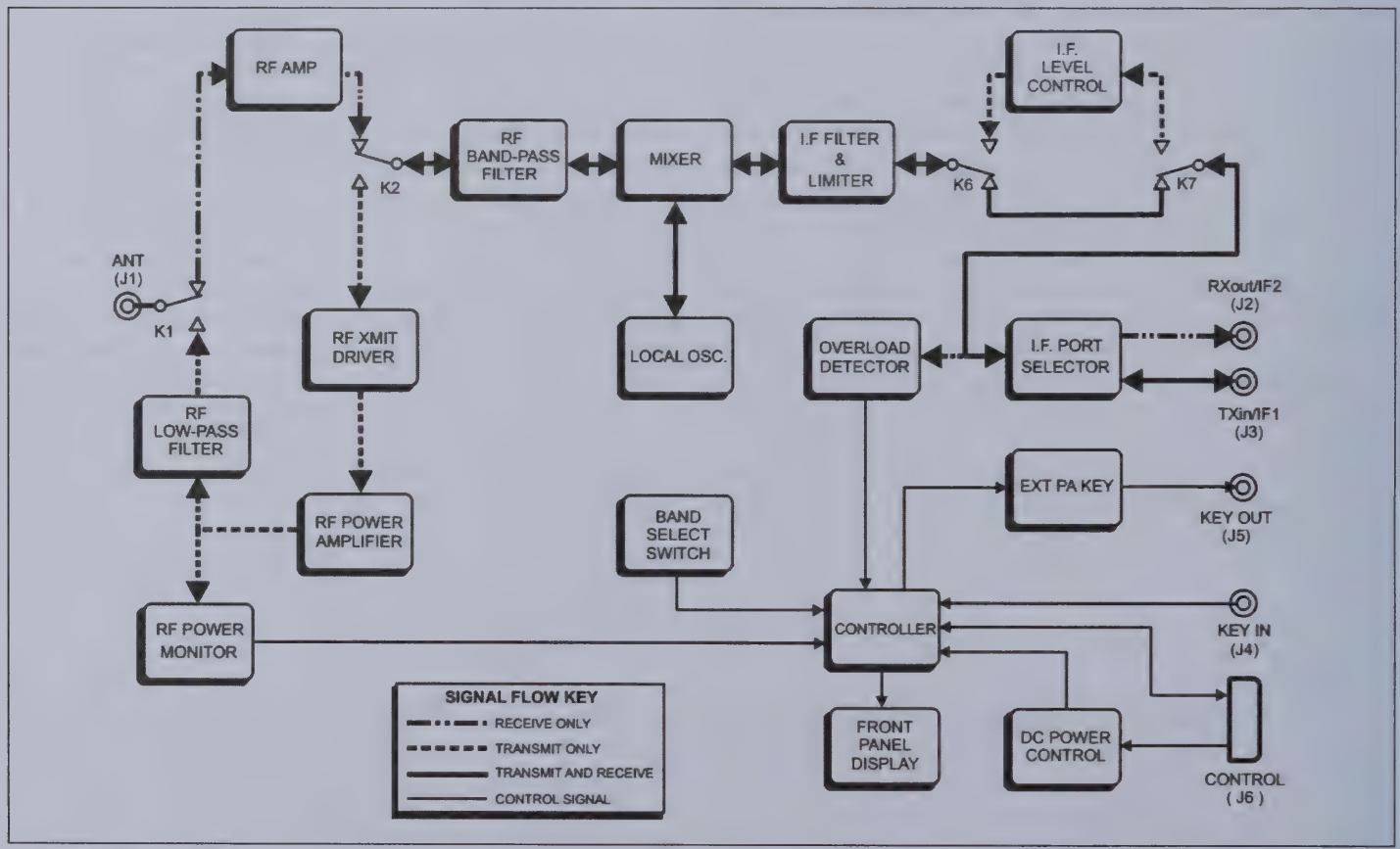


Figure 1—A block diagram of a transverter. The individual receive and transmit paths are clearly identified, as are the paths common to transmit and receive. The IF transceiver is attached to J3 and the antenna to J1.

converter and a transmitter converter coupled to a common local oscillator. Thus, the original transceiver retains all of its functionality, but is on a new VHF band. Figure 1 shows the block diagram of a typical commercial transverter. While the block diagram has some filtering and control circuitry that one can ignore at this point, one can see the basic functionality. The IF transceiver is input on the right at the TXin/IF1 node (J3). When receiving, the signal comes from the antenna (J1), goes through the RF amplifier, through a band pass filter, to the mixer, where it is mixed with the local oscillator, then through another filter and eventually out to the transceiver. When transmitting, the signal takes the reverse path, the transmitter goes to TXin/IF1 node (J3) to the mixer, where it is mixed with the local oscillator, which in turn goes through some filtering to the RF drivers and eventually to the RF power amplifier to the antenna. If you understand superheterodyne receivers, you should have no problem understanding transverters. There is usually some control circuitry in the box as well as filtering. Filtering is a critical part of a transverter performance as with all the frequencies running about between the transceiver and the transverter there are a lot of combinations that can give rise to spurious signals.

Transverters are available from several sources. Table 1 shows the various suppliers and contact information for current transverter manufacturers. As you can see there are a wide variety available. The differences are too numerous to go into in detail here, but the differences are usually in IF frequencies, power output, interface flexibility, and front end noise figure. I have given URLs for the manufacturer's web pages so that you can explore the possibilities yourself.

There are also transverters available on the used market. The Ten-Tec transverters are usually inexpensive, <$100, and are good performers as well as a good buy. Ten-Tec made both 2M and 6M versions. The 2M version was the subject of a QST article that showed how to convert it to 222 MHz.

While any of the transverters I mention above will get you on VHF/UHF, from here on I am going to focus on the Transverters Store transverters. There are two reasons for this, one they are low cost, $85 to $95 for an assembled unit ready to go in a box, kit versions for $70 to $75, and the individual assembled boards at $40 to $55 for the pair, assembled. At these prices one can get started on VHF/UHF without a big expenditure and if one becomes disillusioned with it, then one has not spent out a lot of money and time to find out if one enjoys it. If you use the Transverters Store transverters, you should be aware that some have rather large IMD products as shipped. These IMD products can reduced significantly by adjusting the final gate bias to 3.1V. W7QQ and I measured several of the 222 MHz versions and reported our results as well as how to adjust the gate bias on the NMVHF page:

http://www.nmvhf.org/Ukranian%20Transverter%20Transmit%20Performance.pdf

Homebrewing a transverter is not a task to be undertaken by a newcomer, but K8IQY has designed and built a 7 MHz to 50 MHz transverter as part of his 2N series of projects. It is not extremely difficult for the intermediate to advanced homebrewer to build and uses 2N2222As throughout, except for a single PNP that is used to simplify transmit-receive switching. The circuitry is quite straightforward, there are no hard parts to source, and it is easy to understand. Further details can be found at Jim's website:

http://www.k8iqy.com/qrprigs/2n26/2n26page.htm

The transverter, built in Jim's Manhattan style is shown in Figure 2.

With simple, easy to understand circuitry, the transverter is easy to modify. For example, one could use lower noise transistors in the receive section and a single VHF transistor for the final.

COMPANY	BANDS AVAILABLE	URL	NOTES
DOWN EAST MICROWAVE (DEMI)	902MHz To 10GHz	http://www.downeastmicrowave.com/Default.asp	
Elecraft	50MHz, 144MHz, 222MHz	http://www.elecraft.com/elecraft_prod_list.htm#xvs	Kit, easy to integrate, especially with Elecraft transceivres, versatile, 15W out
Kuhne (DB6NT)	70 MHz to 76 GHz	http://shop.kuhne-electronic.de/kuhne/en/shop/amateur-radio/converter-transverte/transverter/	Kits or assembled, wide variety of IFs and powers available, not just plug and play needs a bit of experience, price varies with strength of dollar to Euro, good now
Q5 SIGNAL	50MHz To 432 MHz (Including 70 MHz)	http://www.q5signal.com/	Recently acquired the transverters for bands below 902MHz from DEMI
SG Lab	902MHz, 1296MHz, 2300MHz	http://www.sg-lab.com/amateur.html	Inexpensive (Approximately ($200) high performance 2W out
SSB Electronics, USA	50MHz to 2304MHz	http://www.ssbusa.com/transys.html	
Transverters Store	50MHz to 432MHz (including 70MHz)	http://transverters-store.com/	Inexpensive, kit or assembled ($95) good performance 5W out

Table 1—Currently available commercial transverters.

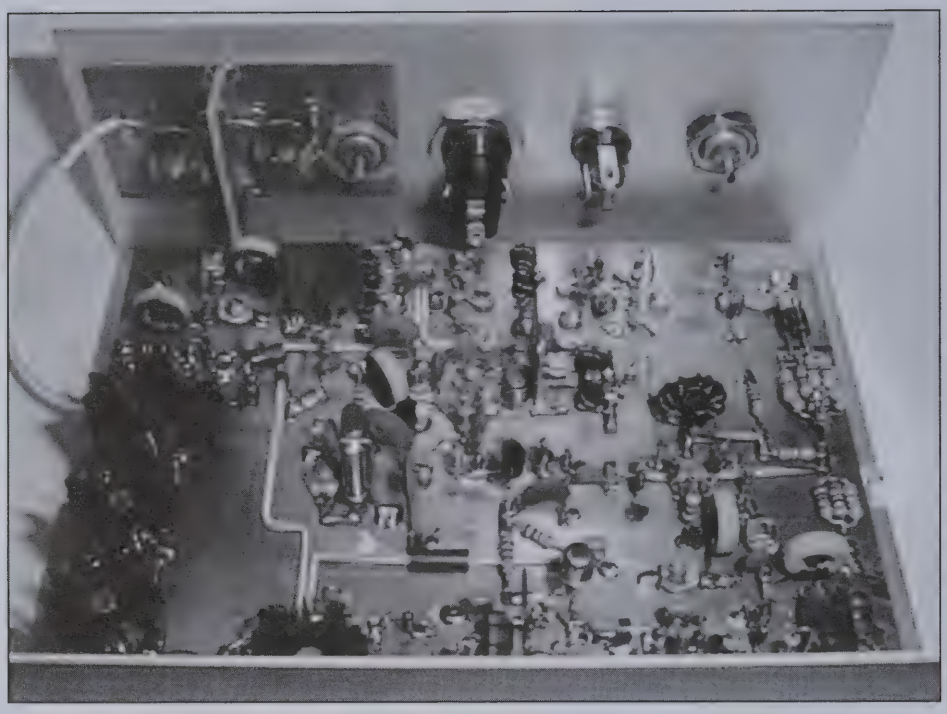


Figure 2—K8IQY's Six meter (RF) to 7 MHz(IF) transverter built with his wonderful Manhattan style construction. Except for a single PNP transistor used in the control circuitry, the transverter uses 2N2222A transistors exclusively, even for the finals.

IF Radios

Although the performance of the HF transceiver does not need to be state of the art, the IF radio should have good performance by itself on HF. Adding a transverter to the front end of a poorly performing HF transceiver or one whose ergonomics you don't like won't make it perform better. However, most HF QRP radios are adequate to use for IF transceivers. Most transverters for the VHF/UHF bands use 28 MHz as the IF, so that is a requisite when considering IF transceivers. There are exceptions. The Ten-Tec 1208 6M transverter uses 14 MHz as an IF for example. I think that one important requirement for an IF transceiver is CW capability as that buys one many dBs when signals are weak.

Many of us started with the old Radio Shack HTX-100 as an IF transceiver and some still use it. It has its problems, chief among them being poor opposite sideband rejection on CW and it is getting long in the tooth with parts possibly hard to come by. It's successor, the HTX10 has also been used, but due to its lack of CW, it is not as well used for an IF transceiver. The HTX-100 needs to be modified to bring out the PTT, and can also be modified so that the output comes from the drivers rather than the finals, which allows one to use less power to drive a transverter. The big drawback to the HTX-100 is its lack of LSB and FM. The LSB is not really a problem, but there are often stations on FM that one can work for additional points or multipliers if one has that capability. Uniden made similiar models to the HTX-100: the HR2510 and HR2600. These both have LSB and FM, so they are more desirable, but they were made in fewer numbers so they are scarce.

There are probably a lot of old Index Laboratories QRP Plus transceivers out there gathering dust with the new crop of more capable QRP transceivers passing them by. They will do fine as IF transceivers for VHF though. Again, repair and parts availability may be an issue. Many older Icom, Kenwood, and Yaesu HF transceivers have low level IF outputs for transceivers and are quite serviceable for IF use, other than often times being too bulky for portable use. If you have a rig with the finals blown and no longer available, you may be able to repurpose it as an IF transceiver by using the drivers, assuming they are still good.

The Elecraft radios interface nicely with the Elecraft line of transceivers with a minimum of hassle. The Elecraft radio will read out the transverter frequency directly and you can daisy chain the KIO bus on several transverters so that the transverters appear as separate bands on the transceiver's band switching function. The K3, K3S, and KX3 can be fitted with internal transverters for 2M which makes operation of them just like having another band in the transceiver. They can also be used with external transverters of other brands though. The K2 is a nice IF transceiver, the only real downside being the lack of FM capability, but that is not a deal breaker.

The FT-817 is widely used as a 144 MHz or 432 MHz IF transceiver for the microwave bands. Although the FT817 already has 6M, 2M, and 70cm, the 28 MHz output can also be used for a 222 MHz transverter IF, leaving one with a simple and effective 4 band QRP station. You will need to do some switching or use a duplexer to get 4 separate outputs from the 2 antenna ports. I discuss that in more detail below.

The ìBITX HF QRP transceiver board, recently made available by HF Signals, is very reasonably priced, $119 plus $10 shipping, and will make an inexpensive IF transceiver. This is a fully functional QRP 80M to 10M transceiver board with digital display. One only needs to wire up the controls and put it in an enclosure. More details are available at < http://www.hfsignals.com/index.php/ubitx/ >.

The Flex 1500, a Software Defined Radio (SDR), has low level transverter transmit and receive outputs/inputs in addition to the normal high level (5W) output. With an attached computer, the a spectrum display is very useful in finding weak signals, particularly on the microwave bands. There are a lot of other possibilities for IF transceivers and I have only scratched the surface here. Some choices are better than others, but if it gets you on the band, then it is worth it. Using more than one transverter with an IF transceiver

If you want to use more than one transverter with a single IF transceiver you will need to switch between the transverters. One can use a conventional coax switch, as shown in Figure3C but there are other inexpensive options as well. I use an AV switch shown in Figure 3A, which has the advantage that the audio channels can

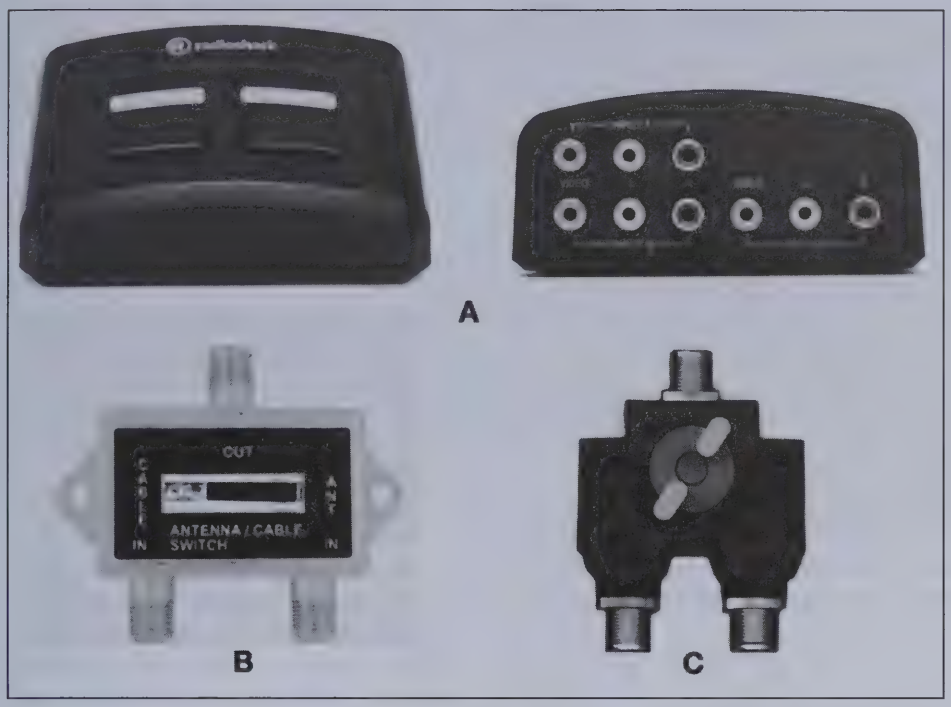


Figure 3—Switches that can be used to switch the output of an IF transceiver between multiple transverters. (C) is a conventional coaxial switch, (A) is an AV switch made by many manufacturers, which can switch the 28 MHz IF with low loss and minimum crosstalk through the Video jacks, the audio jacks can be used for PTT or keying lines, (B) is a simple cable or game switch.

be used to switch PTT or keying lines. The cable switch, or game switch, shown in 3B can also be used to switch transverters and they are very inexpensive. The conventional coax switches are available in multiple ports if you want to use more than two transverters, as are the AV switches. These switches are available from a number of different sources.

Some popular modern QRP rigs, notably the FT-817 and the KX-3, use the same antenna jack to output both HF and 6M. The FT-817 has two antenna jacks, but if one wants to use the three internal bands as well as drive a transverter, then some way must be found to switch between the bands. A simple switch, as shown above can be used. A bit more elegant solution is a duplexer as shown in Figure 4. The duplexer is simply a high pass filter and a low pass filter in parallel so that all the frequencies below the low pass filter cutoff go to one port and all the frequencies above the high pass cutoff go to the other port. A block diagram of a HF/6M duplexer is shown in Figure 4. A Duplexer will take a single port, in this case the antenna port on the FT-817 or KX-3 that has both HF and 6M signals on it and split it into outputs that contain each single band. Figure 5 shows such a duplexer made by Comet, their model CF-360. Diamond makes a similar Duplexer. One can home brew a duplexer, but the steep cutoffs required in an HF/6M duplexer require careful construction, selection of components and good measuring capability.

A similiar diplexer can be used to separate the 144 MHz and 432 MHz signals on the second port of the FT-817. These are also available commercially from Diamond or Comet. Due to the greater frequency separation it is much easier to build a duplexer for these bands. Kent Brittain, WA5VJB has a nice article on his web page with a clear discussion how to build such a duplexer atfor 144 MHz/432 MHz

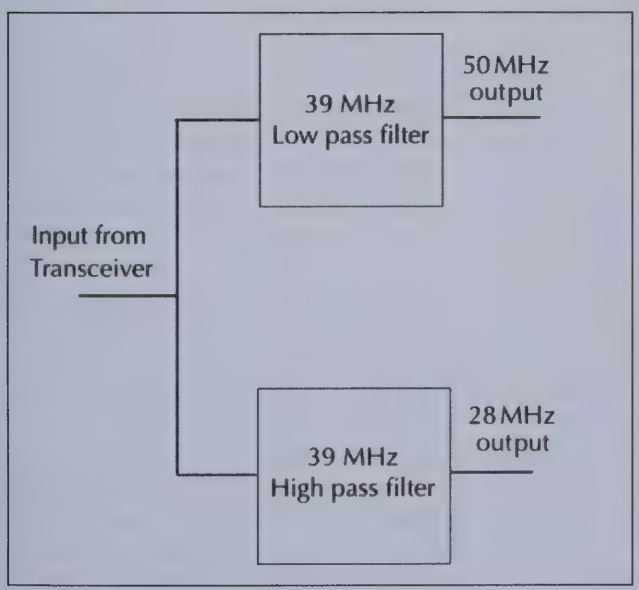


Figure 4—An HF/6M duplexer block diagram. The duplexer consists of a high pass filter in parallel with a low pass filter. The frequency shown, 39 MHz is the geometric mean of 30 MHz and 51 MHz.

Figure 5—A duplexer that allows one to separate 28 MHz signals from 50 MHz signals when the two bands share the same antenna port, such as on an FT-817 or KX-3. Similar units are available for 144 MHZ/432 MHZ and other band combinations. When the band separation is large, it is relatively to homebrew your own.

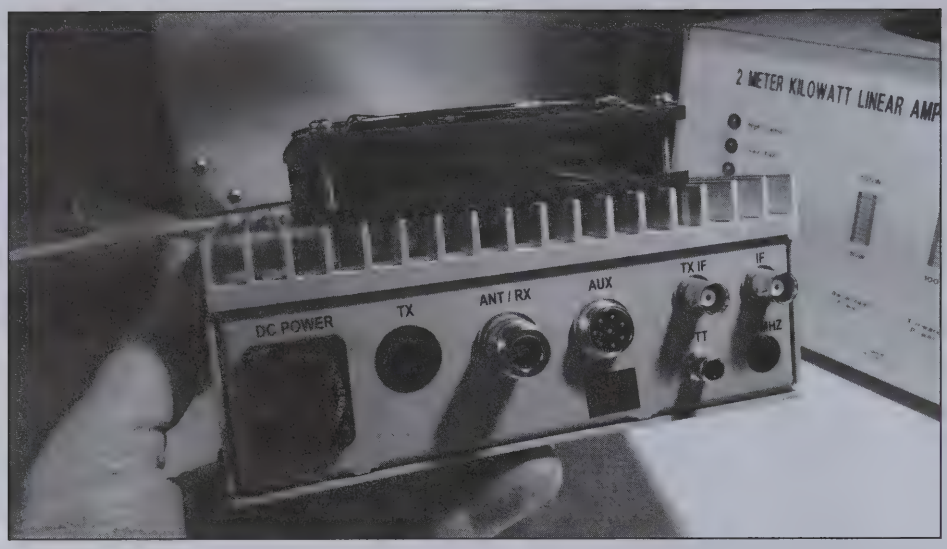


Figure 6—Interface connections to a transverter. Not all transverters have all these connections, and some have fewer, but this is representative of what needs to be hooked up to make a transverter work.

in his discussion on how to build easy antennas for the low earth orbit at (LEO) satellites.

http://www.wa5vjb.com/references/Cheap%20Antennas-LEOs.pdf

It is simple to build and requires no exotic parts. Best of all, it is quite forgiving to assembly techniques and parts tolerances, so you can put it together and use it without having to tune it.

Interfacing Transverters with IF Transceivers

Figure 6 shows the business end of a transverter, that is includes the connections required to interface the transverter The transverter shown is a Down East Microwave. Most transverters offer the same facilities for interfacing, albeit perhaps in slightly different form. There are three essential power, antenna, IF transceiver, and push to talk (PTT) or keying. There are a few precautions that one needs to follow when interfacing to a transverter. One, the power level out of the transceiver should be at or below the level required to drive the transverter. If not, damage could occur. Most transverters have provisions for adjusting the drive levels to match the drive levels of your transceiver. This may be in the form of a potentiometer or with interchangeable fixed resistors. As most transverters have substantial gain margin, sometimes fixed external attenuators are used as was the case with early Microwave Modules transverters. These external attenuators can be easily misplaced, so if you are bought a used unit be sure to check if one is needed or not. Needless to say, you should adjust your transceiver to match the drive requirement of the transverter. I find it easiest to set all my transverter drive levels to the same level. That way I have no problem remembering what the drive level required by the transverter is.

The PTT line is important and is connected to the PTT line of the transceiver. It is not a good idea to transmit into your transverter when it is in the receive position, although many models do have some simple protection against this. Most transverters have a PTT to ground configuration when going from receive to transmit, but there are some that put a positive voltage on the PTT line to switch. Be sure you which one you have. In a multi-transverter setup, it is useful to tie all of the transverter PTT lines together. This is the easiest way to prevent possible to the front end of a transmitter from large out of band power. That is usually not a problem running QRP, but if you move up to high power, it can be, so you may as well get in the habit of doing it now.

Some transverters have provisions for separate receive and transmit IF lines. For a beginner it is easiest to interface with a single line but separate lines are useful in some instances, for instance using a Software Defined Radio (SDR) for receiving and a transceiver for transmitting. Power is self explanatory; most, if not all, transverters operate on 13.8VDC. Be sure that the current capability of your supply is adequate. Many transverters offer an accessory jack that can provide an assortment of transverter information, remote on/off, power out indication, power output, alternate PTT inputs, and a DC supply feed through (watch the current you draw on this line). These can be useful in many applications, but can be ignored by the beginner.

With high power operation, proper sequencing of the order in which things are turned on is important. One would like the transverter PTT to be switched on before drive power is applied for example. At QRP power levels, this can generally be ignored safely, but if you move on to higher power levels it needs to be considered. Many transceivers delay the start of transmit until a certain time after the PTT line is activated, so there is some protection built in anyway. And finally, one should hook up a good antenna to the antenna port.

The Transverters Store transverters and the Ten-Tec 1208 transverter have a nice feature for using multiple transverters from a single IF transceiver. When "off ", the IF (usually at HF) is routed to a back panel connector, bypasssing the transverter. If one is driving more than one transverter from the same transceiver port; by daisy chaining the transverters, that is connecting the HF out on one transverter to the HF in on the next, no additional switching is needed. Just turn the transverter for the band you want to use on, and the rest off. To switch bands just turn the present band off and the band you want to go to on, all the while making sure that the bands you are not operating on are off. Figure 7 shows the front and back of a transverter with these provisions. You will also need to daisy chain the PTT lines.

Antennas

I will just lightly touch on antennas as I have discussed that topic previously. See the 2012 FDIM proceedings for details on a simple 6M Moxon you build, as well as the WA5VJB simple Yagis; http://www.wa5vjb.com/yagi-pdf/cheap-yagi.pdf . I also discussed antennas for VHF QRP portable operation at QRPacificon in 2011 and that presentation

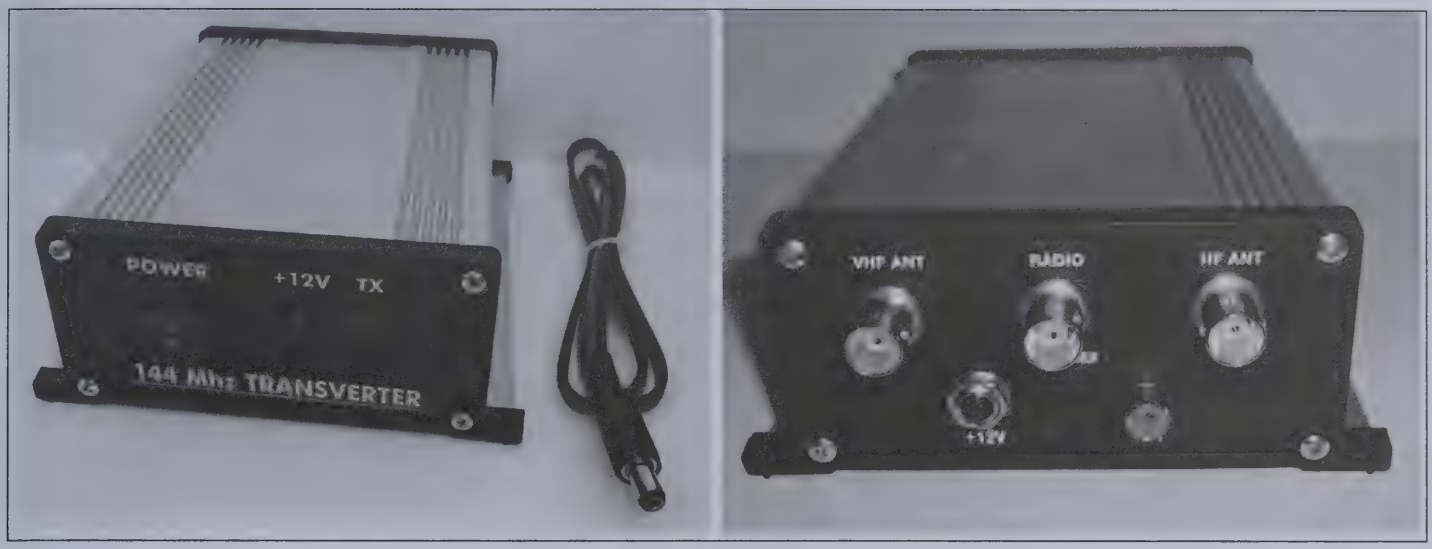


Figure 7—Front and back of Transverters Store transverters. By daisy chaining transverters, that is connecting the HF ANT out on one transverter to the RADIO input on the next, band switching can be done with the front power switch, without additional switching.

is available at the NorCal Website at:

http://www.norcalqrp.org/files/VHF_and_UHF_Antennas_for_QRP_Portable_Operation.pdf

That presentation includes some information that overlaps my information in the FDIM presentation, but it also includes information on a simple portable collapsible 6M Moxon and on the DK7ZB 2M/70cm dual band Yagi with a single feed point.

For single band operation, I recommend either the WA5VJB Yagis for 144 MHz and up or the Moxon for 6M. The DK7ZB dual band Yagi is particularly attractive for those who use the FT-817 as it can be attached to the antenna port that is selected for 144 MHz/432 MHz with no additional switching.

Putting a Spare 28 MHz Transceiver on VHF

The most straightforward way to put an existing QRP transceiver on VHF/UHF is with the Transverters Store transverters. If an external PTT is not provided, you may have to find a way to get a PTT signal out of the transceiver. In many cases there is information available on the web on how to add an external PTT line.

One simply daisy chains the transverters, that is connects the HF ANT output of one transverter to the RADIO input of the next, and connect all the PTT lines in series with the rig PTTs. To switch bands, on turns the power on the transverter for the band one wants to operate and the power off on all the others. If power to all transverters is off, then one can operate on HF as normal.

One can also switch the transceiver output between the various transverters conventionally.

Putting your FT-817 on 222 MHz and Using it as a Four Band VHF Station

The FT-817 is a very capable three band VHF/UHF rig. It is simple to add the 222 MHz band with a transverter. The 222 MHz band is a great band to operate and your local VHF/UHF operators are eager for newcomers appear on the band.

The easiest way to use a transverter with the FT-817 is to set the band outputs up in Menu 7 so that bands 28 MHz and 50 MHz come out the rear (UHF) antenna port, and 144 MHz and 432 MHz come out the front. From here, one has several options. With a generic transverter, one can connect the 28 MHz/50 MHz output to either a switch or a HF/VHF duplexer. It is easiest to use a duplexer, then one can do all the band switching from the FT-817. The duplexer takes care of the switching between 28 MHz to drive the transverter and normal 50 MHz operation. One connects the transverter input to the duplexer HF output and a 50 MHz antenna to the VHF output of the duplexer. One can use a conventional switch instead of the duplexer to perform the same function. If using the Transverters Store transverters, one can simply connect the RADIO input of the transverter to the FT-817 output and the HF antenna transverter output to the 6M antenna. To operate on 222 MHz, set the FT-817 to 28 MHz, turn the transverter on, and operate. On 6M, set the FT-817 to 50 MHz, leave the transverter off, and connect the a 50 MHz antenna on the HF ANT port of the transverter. This is less elegant as the transverter needs to be switched as well.

For 144 MHz/432 MHz one has a couple of options. One can use the output as is and feed a 2M antenna. Most, but not all, 2M antennas have a low impedance on 432 MHz as it is the third harmonic of 2M, so you can try operating this way. The pattern will be different, split into three forward lobes, so you may need to off point the antenna for best results. This is not elegant, but it will get you on. The second option is to use a dual band antenna, such as closely coupled resonator designs of DK7ZB, available on the web. These are relatively short boom antennas, but are very nice for portable backpacking operation. The third is to use a duplexer to split the two bands. If one does the splitting at the antennas, then one only needs a single feed line rather than two.

Putting your KX-3 on 222 MHz and other VHF/UHF bands

The KX-3 can be put on 222 MHz in a

manner similiar to the FT-817, that is use a duplexer on the antenna output of the KX-3 to drive a transverter and a 50 MHz antenna, use a switch to select between the transverter and 50 MHz antenna, or use the internal switching in the Transverters store transverter to switch between the transverter (power on) and the 50 MHz antenna (Power off). Elecraft offers a internal 2M transverter option as well, although the power, 2.5W, is a bit on the light side. One can also use a multiple pole switch to switch between more than a single transverter.

Operating Notes

I won't go into operating VHF/UHF in much detail as I covered that in my previous 2012 FDIM talk. But some quick things to get you started:

1. Know your grid square. Grid squares get exchanged at VHF. The four digit is usually sufficient, however for microwave work the 6 digit is usually exchanged and on the lower bands it helps home stations locate. There are a number of web pages that will give you your grid. Just google Grid Square locator. I like the one by HA8TKS < http://dxcluster.ha8tks.hu/hamgeocoding/ > . This app allows you to click on your location on Google Maps and returns your grid square. Thus there is little left to doubt.
2. Many areas have weekly VHF/UHF activity nights or weak signal nets which are good for the beginner to learn the ropes of VHF/UHF operation. Your ARRL SCM should be able to tell you the times and dates these are held.
3. Use CW when the going gets tough. CW has a 10 to 15dB advantage over SSB at the noise level. If you can hear a station and they don't come back to you on SSB, give them a shout on CW. CW is the QRP ops friend.
4. Operate the contests. There are a number of VHF/UHF contests each year and you should participate in them. They offer good practice on techniques, supply new grids and get you to know the locals. Most contests have a separate QRP category and for the purposes of VHF contesting, 10 Watts is considered QRP.
5. Get to know the local VHF/UHF operators. If there is a local VHF/UHF group join.

References

1. Botts, J.G., K4EJQ, Buchanan, Bill, WB4WEN, "Get On 222 MHz with a Ten-Tec 1210", *QST*, May 2001, page 28. Note the sidebar on requiring an external filter to comply with FCC regulations on spurious emissions. See also Technical Correspondence, April 2002 *QST*, for comments on the LO frequency tripling scheme.
2. Duffey, James R., KK6MC, "VHF and UHF Operating for the Beginning QRPer", *Four Days in May Conference Proceedings*, May 17, 2012, page 61.

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A Modest SOTA Activation Antenna

Mike Herr—WA6ARA

My personal rule is "the lighter the better—but it has to be functional!" My SOTA activation antenna is the result of several years of trial and error. First, most of my activations are within a 50 mile radius of home, home being Ridgecrest, CA, in the Mojave Desert. We are located sort of between the east side of the Sierra Nevada Mountains and Death Valley. Most of the peaks I go to there are no trees of any sort, only barren rock and decomposing granite. You need to take your own support and make it work. I've tried the crappie pole and dipole configurations but so far found them lacking. The Buddipole worked great but tended to be on the heavy side. In the end, the vertical has become my "go to" SOTA antenna.

I had not been a big fan of verticals. I always prescribed to the saying "a vertical radiates equally poorly in all directions". But my thoughts have changed after using a simple vertical in the field. My vertical starts with a few Buddipole components, namely one of the adjustable coils, the Versa Tee, and a couple of the arms. I add to this an old military AN-131 whip antenna and a homebrew adapter to go from the Versa Tee to my hiking pole.

The AN-131 use to be available and cheap but are getting rare to find. If you see one, grab it! It is a multi-sectional, light weight antenna about 10 feet long with a standard 3/8-24 thread. Instead of a shock cord inside it uses a steel cable and spring. So 70 years after manufacture it still works, shock cord won't do that! It folds down to a nice package about 17 inches long.

The overall configuration is shown in Figure 1. I made an adapter (Figure 2) to go from the Versa Tee to my hiking pole. I turn the pole upside down, wedge it amongst some rocks (Figure 3) and place the adapter / Versa Tee on the normally ground end of the pole.

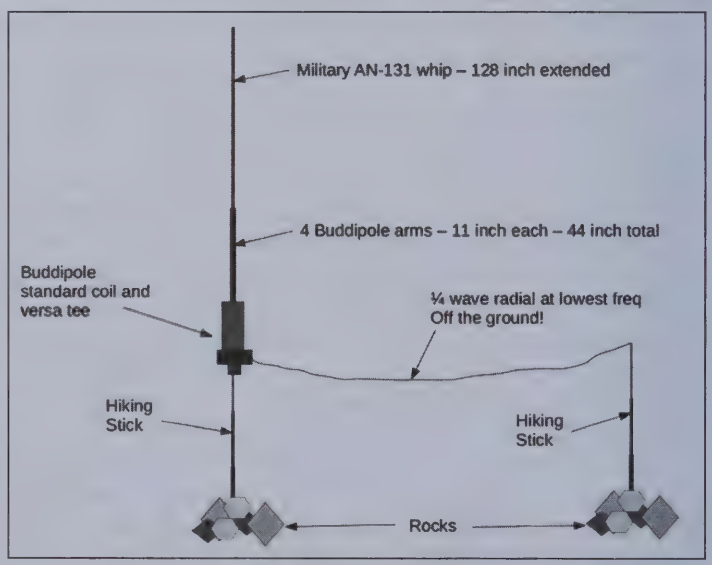

Figure 1—Diagram of the SOTA antenna setup.

On top of the Versa Tee I mount one adjustable Buddipole coil.

Figure 2—Adapters and other pieces of the antenna.

Figure 3—The antenna is wedged in the rocks for support.

It turns out the coil is too much for the antenna, as I only use about half or less of the coil. But it is what I have on hand and more work needs to be done to reduce this. On top of the coil I add four of the Buddipole 11 inch arms, and then the AN-131 whip on that. That makes the overall length of about 172 inches. At the Versa Tee I add a single radial wire, attached to the shield of the coax. This is wound up on a kite string holder. I usually pull it out to a quarter wavelength on the band I want to operate on, leaving the rest on the kite winder. I use my second hiking pole to support the end of the radial. I ALWAYS keep the radial up off the ground. When it was on the ground the performance was poor. Sometimes I just put the radial out to the lowest frequency I intend to operate on and leave it there, with acceptable performance.

The proof of any antenna is "does it work?" Yes, so far I have been very happy with this. On a typical SOTA I work 15 to 30 stations, from New Zealand to Spain. Modeling showed a decent take off angle and some gain in the direction of the radial. My own modeling as well as experience confirms it.

I have future plans to further reduce the weight, bulk and complexity. I am working on a single coil/hiking pole adapter to replace the adapter/versa tee and coil I am now using.

So give this configuration a try, especially if you are above the tree line or in the desert. I think you will be happy.

VE3IPS— You can also use an AT-271 whip, Buddipole or MFJ-1996 Telescopic Antenna as well. I like the idea regarding the hiking poles as antenna supports.

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Back Pack Radio Antenna Extension Arm

I wanted to simplify the ability of connecting a Buddistick, a SuperAntenna or a Chameleon MPAS onto my Icom back pack or Alice frame pack. I found plumbing fittings that would screw onto some threaded PVC ends. The CB style stud mounts fit perfectly. I added a 12 gauge copper wire in between to provide continuity if need be. The top is a female 3/8-24 mount and the bottom uses a SO-239 with a 3/8-24 stud from a CB antenna. Now I can easily Velcro it to the side of the pack or on a Mil-Spec Alice Frame pack as well. —*John VE3IPS*

An Introduction to Multi-Wire Loops

Gary Breed—K9AY k9ay@k9ay.com

Since developing the K9AY Loop in 1996, I've been investigating multi-turn versions of the antenna. From doodling on napkins to large computer models, I explored the various ways to implement the antenna with more than a single wire.

Finally, in 2014, I did experiments that verified the performance I had seen in my modeling trials. Before doing real-world tests, I had not trusted the accuracy of the computer simulations, since the configurations seemed to be outside the guidelines for NEC, the computational engine inside nearly all modeling programs.

Let's take a look at the different ways to build and connect multiple wires in a loop antenna. Then later, I'll describe some practical uses for these configurations.

Multiple Independent Loops

The modeling experiment that led to the first configuration is shown in Figure 1. Fig 1(a) is a broadside array of five K9AY Loops, with 1/4-wave spacing on 160 meters, all fed in-phase. Actually, I was designing an array that worked on both 80m and 160m.

I also modeled the array with smaller spacing, to see how the array behaved with a smaller footprint. I noticed something quite interesting: the gain hardly changed. I kept reducing the spacing (Figs. 1b, c), down to quite small spacing, as in Fig. 1(d). The total gain difference between 135-foot spacing and 2-foot spacing was only 1.5 dB.

From this, I realized two things: 1) the gain was primarily a result of summing the outputs of several loops, rather than a result of the phase and spacing of the array; and 2) the low efficiency of the loops reduced interaction, allowing very close spacing.

To summarize, this is the first of three multi-wire loop configurations; independent loops, closely spaced, with separate feeds, as would be accomplished with a power combiner having good port-to-port isolation.

Example: An Inline Array

If you have a K9AY Loop built to the original design, it has a very broad forward lobe and one narrow, but very deep rearward null. One of the ways to obtain a more directive pattern is to build an array of two or more elements. One such array with good performance is a 3-element inline (endfire) array, shown in Figure 2a. You choose the spacing and phasing of the elements according to your available space and desired pattern. Regardless of spacing and phasing, the optimum current distribution among the the 3 elements is:

End 1: 1.0 at – phase shift
End 2: 1.0 at +phase shift
Center: 2.0 at 0° phase

If three K9AY Loops are used, the center element needs to have twice the current of the end elements. The design of a 3-way power dividing/combining network with unequal currents can be complex.

Using the above method of simply placing two loops beside one another, the 2.0 current can be achieved by feeding each of the center loops with 1.0 current. This is illustrated in Figure 2b and is:

End 1: 1.0 at – phase shift
End 2: 1.0 at +phase shift
Center 1: 1.0 at 0° phase
Center 2: 1.0 at 0° phase

Feeding this system is straightforward. A 4-way power divider/combiner with equal outputs is much simpler than a 3-way circuit. And the two loops comprising the center "element" can be installed quite close to one another, requiring almost no more room than a single loop.

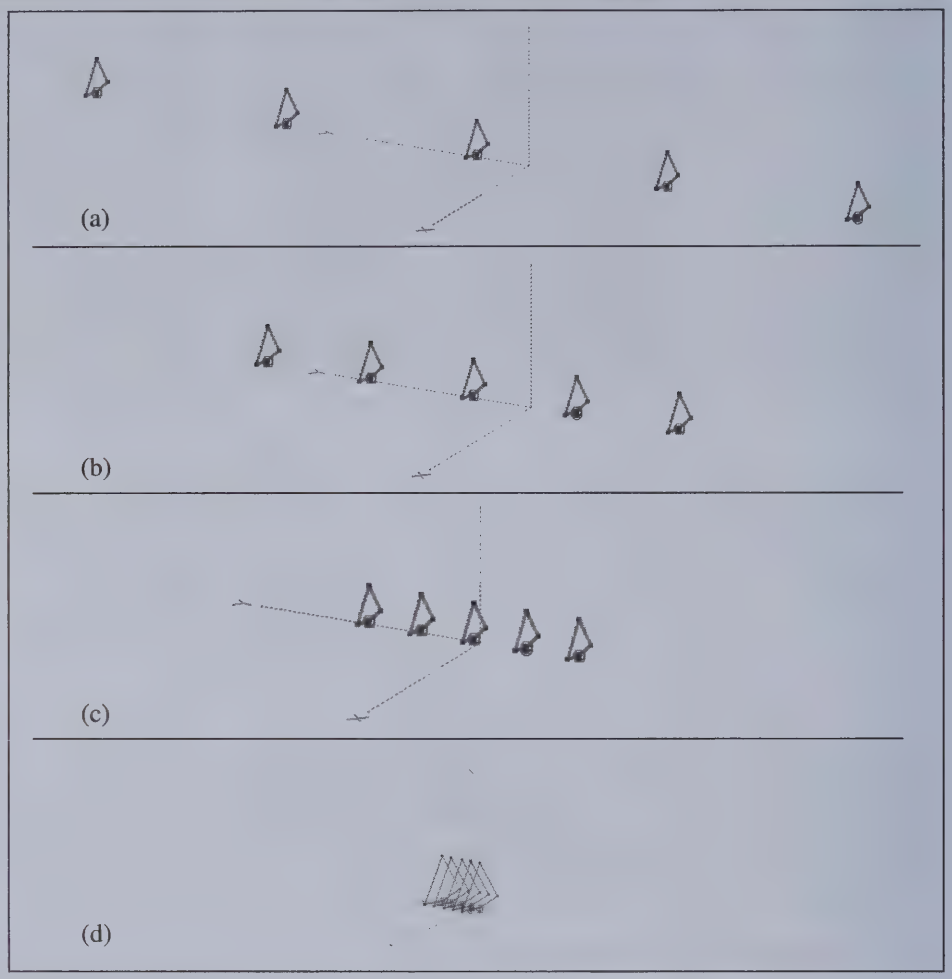

Figure 1—Broadside loops with progressively smaller spacing: (a) 135 ft between loops; (b) 70 ft; (c) 35 ft; (d) 2 ft

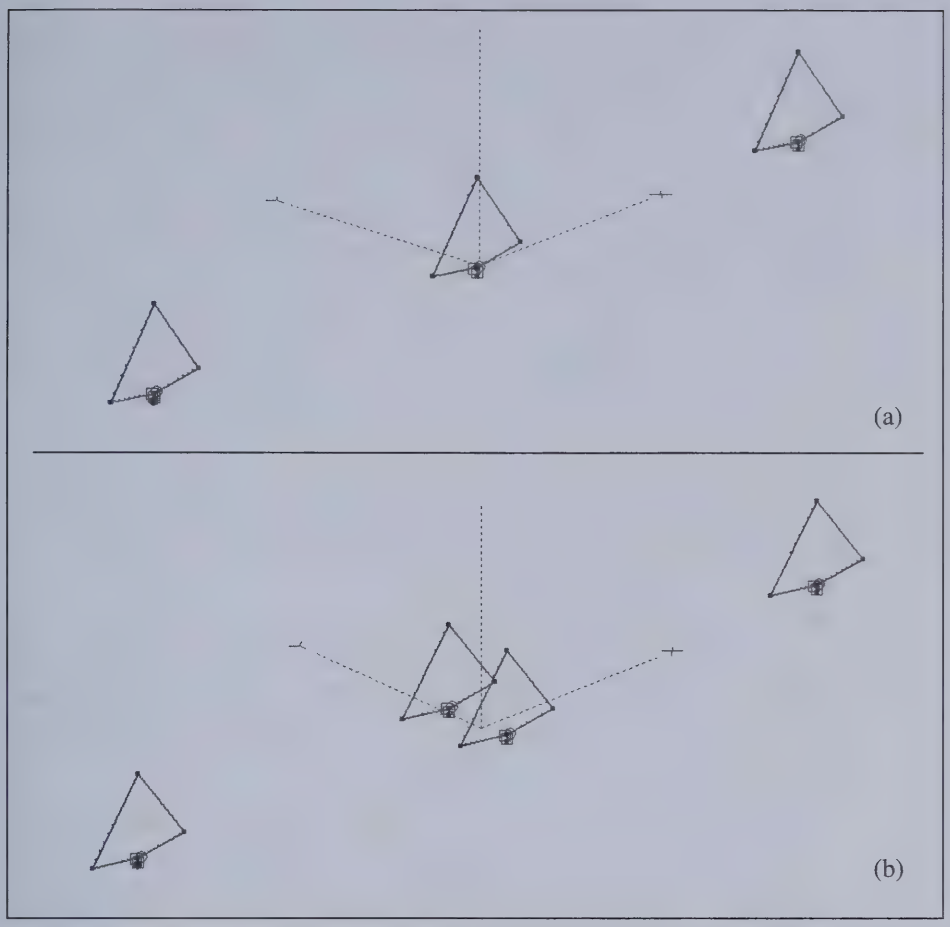

Figure 2—The center element of a 3-element inline array (a) requires twice the current of the end elements. With a double loop as the center element (b), the array now has four elements with equal currents—simpler to implement than having unequal currents.

Multi-Turn Loops

In addition to the above type, derived from an array of loops, I also wondered how multi-turn loops would work. By *multi-turn*, I mean connecting the wires as a coil. A 4-turn loop is shown in Figure 3.

I modeled the 2-turn loop and found that the gain increased dramatically, by 4.7 dB. When I modeled a 4-turn loop, the gain was another 3.8 dB higher. These numbers generally made sense, since inductance is increased by the square of number of turns.

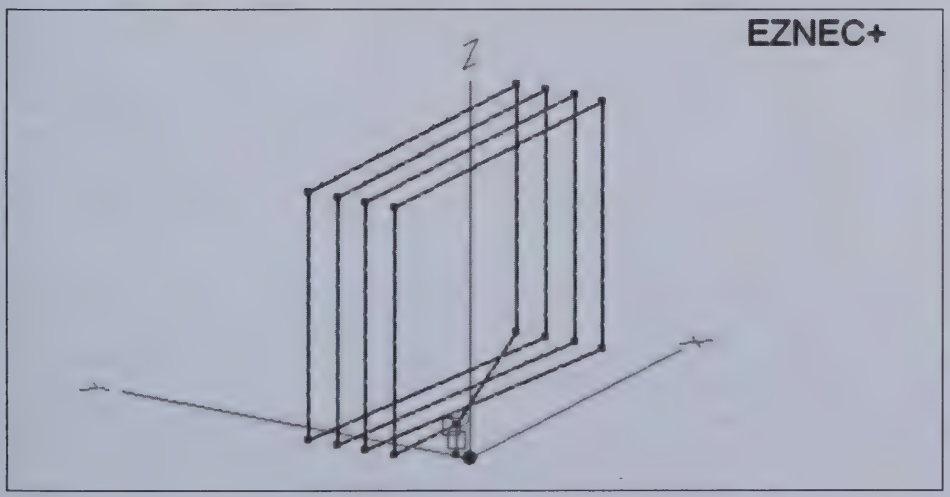

Figure 3—A 4-turn loop configured as a "coil".

But at the time, I was still working to understand the electromagnetic mechanism at work with this antenna. So I wasn't certain whether the result was a modeling artifact or a "real" result.

It would be several years before I decided to take another good look at this configuration. When I did, I had a much better idea how the K9AY Loop, flag, pennant and EWE achieved their directivity by responding to the electric and magnetic components of an electromagnetic wave. I understood that this configuration had a legitimate performance improvement.

There is one very important thing that is forfeited to achieve the multi-turn gain—maximum frequency of operation. With all terminated receive loops, as their size is increased, at some point the operating mode changes and they no longer behave as a "small antenna" (approx. 1/10 wavelength maximum dimension). So if you make it too big—as a larger single loop or by adding wire in a multi-turn "coil"—you can't get a null with a resistive termination.

With this in mind, the best use of a multi-turn loop is to improve the efficiency of a reduced-size loop. A smaller-size loop has a higher "cutoff frequency", and will benefit from the use of multiple turns.

Note: This limitation only applies to this "coil" type of multi-turn loop. The side-by-side multiple loops have the same frequency range as a single loop.

I built and tested a 4-turn loop much like the one shown in Fig. 3—8 ft high by 12 ft long. A single loop of this size has 10 dB lower signal level than a K9AY Loop of the original design, since it is much smaller in area. Using 4-turns, the gain increases by about 8 dB. Comparison measurements with a nearby K9AY Loop confirmed this result.

Multi-Wire Loops

After evaluating the first of these configurations: close-spaced loops, operating independently with outputs combined in an isolated combiner circuit, I wondered if the combiner was really needed. Could multiple loops simply be wired in parallel? And I found that yes, they can.

Parallel connection, shown in Figure 4, has one difference from combined outputs. There are conducted currents that are not present when the loops have a combiner circuit with port-to-port isolation.

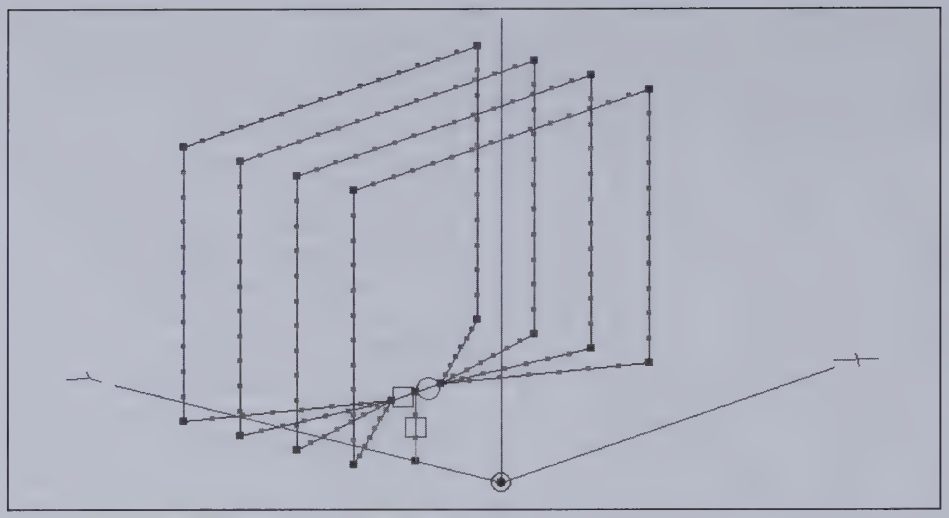

Figure 4—Multiple wires connected in parallel. This 4-turn loop has close to 5 dB gain over a single loop of the same size.

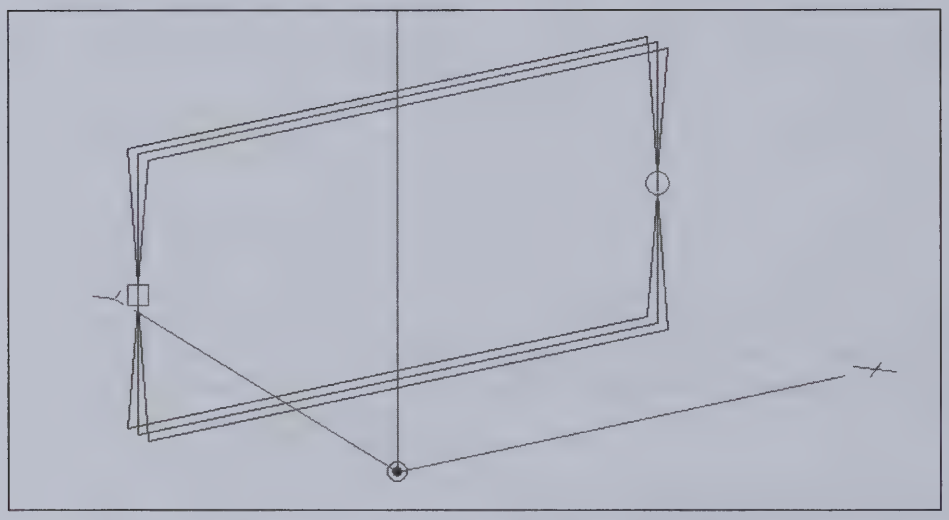

Figure 5—A 3-wire "Super Flag" with higher gain than a single-wire antenna. The concept can be expanded to a 5-wire version with 2 dB more gain.

Fortunately, these are small and the performance is within a fraction of a dB of the "properly" combined loops. It's not much of a tradeoff versus the simplicity of direct parallel connection. The same 4-turn 8x12 set of wires noted above were re-connected in this parallel arrangement. Measurements confirmed the expected gain of 5 dB.

As you would expect, the parallel connected loops also have impedances in parallel. The feedpoint impedance of a 4-wire loop is approximately 1/4 that of a single loop, requiring a proper impedance transformer. The same applies to the optimum terminating resistance.

So now we have the third method of connecting multi-wire loops.

Example: The "Super Flag"

These techniques are not limited to the K9AY Loop. The family of terminated loop directional receive antennas also includes the EWE, the flag, and the pennant antennas.

A practical implementation of parallel wires is with the flag antenna. Figure 5 shows a 3-wire flag with parallel-connected wires. Using multiple wires increases the gain by 4.5 dB over a single-wire flag of the same size. This means that you will need less preamp gain. The higher signal level also reduces common-mode effects—noise or pattern distortion.

If you chose to expand the idea to five wires, you would realize an additional 2 dB gain for a further improvement in signal levels.

The feedpoint impedance of a 1-wire flag is quite high, 920 ohms. Matching transformers to reach 75 or 50 ohms are practical, but harder to build with low loss that lower transformation ratios.

The 3-wire flag has a 310 ohm feed impedance, and a 330 ohm termination resistance. The 5-wire version has a 200 ohm feed impedance, and 220 ohm terminating resistance. The lower impedances of the multi-wire antennas has the benefit of higher isolation across the windings of a transformer—necessary to ensure that the feedline has minimal effect on the antenna pattern. Both 3-wire and 5-wire flags would operate well with a 4:1 matching transformer.

What About Transmit Antennas?

I did not do any experiments with either modeling or test antennas that apply to transmit antennas. I would expect that these methods may not be applicable to transmitting loops.

Transmit antennas are tuned to resonance, with much higher efficiency than resistively-terminated receive antennas. Thus, the coupling between adjacent turns would be much higher—greatly changing the way they interact.

In Reference [1], there are some experiments and analysis that suggests that transmit loops benefit from a larger surface area, particularly a wide, flat surface. The multi-wire antennas of Figs. 4 and 5 resemble such a surface, and may be worth trying with a transmit loop.

If you wish to explore these (or other) configurations of resistive-terminated receive loops, I recommend that you review the modeling notes contained in Ref. [2]. Modeling the K9AY Loop, EWE and other ground-connected antennas is not straightforward. The article referenced describes the process used to obtain a trusted model that can be used with EZNEC and other NEC-2 based antenna modeling programs.

References

1. Douglas Miron, *Small Antenna Design*, Newnes, an Elsevier imprint, 2006.

2. Gary Breed, K9AY, "Modeling the K9AY Loop," *National Contest Journal* (NCJ), Mar-Apr 2015.

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Here's a page for your notes!

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- 80-10 meters (9 bands)
- SSB / CW / Data
- Up to 10 W TX
- Internal 2.6 Ah Li-ion battery*
- Built-in mic for HT-style operation
- Wide-range internal ATU*
- New KXPD2 compact keyer paddle*

*Option

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